U.S. Robotics®

SPORTSTER®

HIGH SPEED MODEMS

with V.42 *bis*

- Sportster 14,400 Fax with V.32 *bis*
- Sportster 14,400 with V.32 bis
- Sportster 9600 Fax with V.32
- Sportster 9600 with V.32

USER'S GUIDE

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USER'S GUIDE

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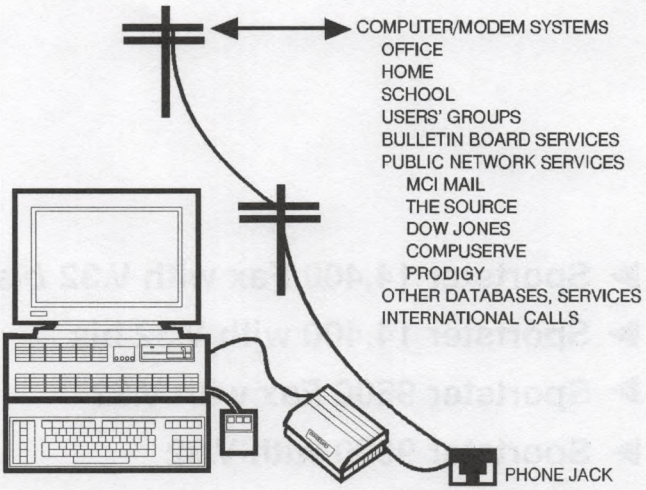
INTRODUCTION

Congratulations! The Sportster modem you've purchased represents powerful, advanced design. It offers exceptional reliability, compatibility and flexibility at all standard rates up to the highest speed your modem is capable of, 9600 or 14.4K bits per second (bps). Whether you're a seasoned modem user or have just purchased your first modem, we're sure it will give you excellent service.

Once you've connected your new Sportster modem to your telephone line, you'll be able to use your computer in exciting new ways. Some of the possibilities are shown in the figure below.



Data Communications Options

HOW TO USE THIS MANUAL

This manual contains summaries and other reference information you may need for configuration and operation of your modem.

Below is a brief description of the manual's contents.

- Chapter 1—Operating and compatibility features
- Chapter 2—An overview of modem communication and how it works
- Chapter 3—Instructions for using your modem to place calls
- Chapter 4—Explanations of the Sportster's factory configuration and instructions for customizing configurations to meet your needs
- Chapter 5—Instructions for making inquiries on status and obtaining Help screens to view current settings

The Appendixes in Part II cover the following subjects.

- Explanation of how certain features of data communication work
- Summaries and tables
- Fax and other operational information
- Procedures for modem testing
- Glossary
- Warranty/Service/Certification information

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CHAPTER 1. FEATURES AND COMPATIBILITY

SPORTSTER FEATURES

The following features and capabilities assure you of superior reliability and performance from your USRobotics Sportster modem.

Error Control—V.42/MNP 2 through 4

Data integrity is ensured when Sportster modems connect with remote modems that use the V.42 (LAPM) or MNP error-control protocols. Error control is available on calls at 1200 bps and above.

Data Compression—V.42 bis*/MNP 5*

Data compression enables throughput of up to 57,600 bits per second (bps) on 14.4K bps connections. The data compression technique used depends on the remote modem's capabilities. If the modems connect under V.42 error control, they can use V.42 *bis* compression. If they connect under MNP error control, they can use MNP Level 5 compression. Achievable throughput for text files and other file types is listed in Appendix A.

Flow Control/Variable Interface Rates

Flow control, required under error control, allows the rate at the serial-port interface to be set higher than the rate over the phone line. This feature provides greater efficiency and throughput. If your computer and software support the higher rate, you can transfer data between the computer and modem at 57,600 bps, regardless of the phone line rate.

Fax Capability

If you've chosen to purchase a Sportster modem with fax capabilities, you can use your modem in Class 1 facsimile mode for sending or receiving faxes, including Group III faxes.

Programmable Nonvolatile Memory

You can tailor your own default settings and store them in nonvolatile random access memory (NVRAM). As long as DIP switch 7 is set UP, the Sportster modem operates at the settings you've specified each time the computer is powered on or reset.

Link Rate Negotiation

The Sportster modem automatically lowers its connection rate to match a remote modem's lower rate, in both Originate and Answer modes. This allows connections with a wide range of installed modems. When answering higher speed calls, the modem also shifts back up again.

Modem Diagnostics

The modem performs three loopback tests: analog, digital, and remote digital. See Appendix D for information.

Inactivity Timer

You can set the modem to automatically hang up after a specified number of minutes if there is no data activity on the line.

Call Progress Detection

An optional set of result codes (screen messages) lets you know when a line is busy or there is no dial tone.

Modem Settings Display

On command, the modem displays its current settings, a handy way to check your transmission rate, S-Registers and other operational controls. The modem also displays the defaults stored in nonvolatile memory and the default configurations stored permanently in read-only memory.

HELP Screens

The modem displays screens that summarize the command sets, Dial command options, and S-Register functions.

Bottom Panel Reference

Summaries of important commands and other information are printed on the bottom of the modem case. A Dual In-Line Pack-

age (DIP) switch guide makes it easy to tailor the switch settings to your computer and software requirements.

Stored Phone Numbers

Write up to four of your most frequently used phone numbers to NVRAM. Then type a brief command to have the modem dial one of the numbers.

Quote Mode

Set the modem to Quote mode if you want it to dial an alphabetic acronym instead of a number.

COMPATIBILITY

The Sportster modem conforms to the following standards, ensuring compatibility with a wide base of installed modems. ITU-T is the new signifier of what was formerly the CCITT international standards body.

ITU-T V.32 *bis*	14.4K/12K/9600/7200/4800 bps
ITU-T V.32	9600/4800 bps
ITU-T V.22 *bis*	2400 bps
Bell 212A	1200 bps (also ITU-T V.22)
ITU-T V.23	1200 bps with 75 bps back channel (Some United Kingdom and European phone systems)
Bell 103	300 bps (ITU-T V.21 optional)
ITU-T V.42	LAPM error control, 1200 bps and higher
ITU-T V.42 *bis*	Data compression, 1200 bps and higher
MNP	Levels 2, 3 and 4 error control, level 5 data compression, 1200 bps and higher
ITU-T V.54	Analog, digital and remote digital loop-back testing

Fax Modems	
TIA/EIA-578	Service Class 1 Asynchronous Facsimile DCE Control Standard
ITU-T V.17	14.4K/12K bps
ITU-T V.29	9600/7200 bps
ITU-T V.27 *ter*	4800/2400 bps
ITU-T V.21	300 bps

Other compatibility features include the following standards and certifications:

- Can be used with any computer or terminal that is compatible with the RS-232 standard interface.
- Can be used with any computer or terminal that uses ASCII, the standard character code supported by most equipment manufacturers.
- Is UL-listed, fully FCC-, DOC- and CSA-certified for the uses described in this manual.

CHAPTER 2. DATA COMMUNICATIONS

This chapter provides a simple explanation of modem communications. For more in-depth information about specific data communications concepts, such as throughput and error control, refer to Appendix A.

How Modems Work

Modem is a term based on the concept of ***mo***dulation and ***dem***odulation. A modem modulates (converts) digital data (computer information) to analog data (fluctuations in tones carried over the copper telephone wire). The information is carried over the telephone network until it reaches its destination, where another modem demodulates the analog signals and converts them back to digital data so the computer there can use the information.

This ability to use the telephone network for quick, inexpensive data exchange is a powerful tool used by businesses and individuals worldwide to expand business and personal networks.

Modem Configuration

Modems come in all shapes and sizes and their ability to communicate is based on the protocols they use, or rules they follow to perform operations in identical ways. They may be preset or reset physically (DIP switches) and logically (communications software) to best communicate with the modem they are transferring information to and receiving information from.

Much of this is done automatically by the modems when they initially contact each other. The calling modem contacts the answering modem and introduces itself. The modems communicate via a series of tones to identify the appropriate protocol, speed, etc., for efficient data transfer. The answering modem either accepts the call or rejects the call. This transaction is called a *handshake*.

Successful handshaking results in what is called *carrier*. When modems establish carrier, your modem sends a *Carrier Detect* signal to your computer, indicating that the modems are ready to transfer data. If they fail to connect, your modem sends your computer a *No Carrier* message.

Line Travel

Line quality may cause a decrease in efficient data transmission. In order to ensure the data sent and received is of good quality, error control was introduced by modem manufacturers. The modems check and recheck each data block sent and received, and if something went wrong between locations, the answering device instructs the sending device to resend the affected block.

Modems send information at different rates, measured in bits per second (bps). Today, depending on the type of network and physical interface (or cable) used, the figures can be staggering. In the most optimal situation, the Sportster can exchange data as fast as 57,600 bps.

In most cases, though, the speed relies heavily on the ability of the sending modem to send, the ability of the answering modem to receive, and the line quality between locations. This is why flexibility and compatibility are some of the most important features of the Sportster.

Digital Data

Modems send data via Asynchronous communication. The smallest data unit sent is made up of a defined word length (7 or 8 bits each), a Start bit (a 0 that indicates where the data unit begins), and one or two Stop bits.

Parity bits were the typical method of controlling errors before cyclic redundancy check (CRC) error correction. A Parity bit is either a 1 (odd parity) or a 0 (even parity), depending on whether the data segment has an odd or even number of binary digits. Some systems allow mark parity (parity is always 1—odd) or space parity (parity is always 0—even). Parity bits are used less often now that CRC is common.

The setting 8-N-1 and 1 (word length=8, parity=None, stop bits=1, and start bits=1) has become the most common data format in data communications. Both computers involved in a data transfer must use the same parity, word length, and number of Stop bits. The software must first be set the same on the computers at both ends of the data transfer before the modems can operate effectively. A simple phone call to determine the settings at the other end can clear this up quickly and easily.

Flow Control

Another important aspect of modem communications is flow control, which manages the amount of data stored in buffers. Flow control is used to prevent buffer overflow. The system uses either hardware or software (data characters) flow control. USRobotics recommends the use of hardware flow control, because the data characters used in software flow control may be mistaken for actual data.

You are the Boss

Modem communication is a powerful tool in business and in the home. But, it is just a tool. You have the power to control and maximize the benefits of efficient modem communication. This manual outlines the options you have in defining how your modem communicates, and your communications software allows you to easily change settings on a per-call, or permanent basis. Enjoy your new Sportster modem.

CHAPTER 3. DIALING AND ANSWERING

This chapter provides an explanation of the various commands you can use to dial and answer with your modem. Many of these functions can be handled by your communications software, but you also have the power to place your computer in Terminal mode and control the modem directly.

NOTE: Settings listed in this chapter as "default" are based on the &F1 template loaded in NVRAM when the modem is shipped.

USING AT COMMANDS

To send commands directly to your modem, first put your computer in Terminal mode. Some communications programs do this automatically upon loading. Others require you to display a communications terminal screen, press a Function key, or perform some other operation. If necessary, refer to the *STOP* guide or your communications software documentation for instructions.

1. Type all commands in either upper case (AT) or lower case (at), but not a combination (At).
2. All commands except A/ (re-execute last command) and +++ (escape code) are preceded by the AT prefix and are executed with the Enter/Carriage Return key (<Enter>).
3. Command string length = 40 characters, maximum. The modem doesn't count the AT prefix, Carriage Return character, or spaces. In a dial string, it counts—but doesn't act on—punctuation such as hyphens and parentheses.
4. A missing numeric parameter is assumed to be zero, as in the command to hang up: ATH <Enter> is the same as ATH0 <Enter>.

BASIC COMMANDS

There are two basic commands you should become familiar with when controlling your modem while your computer is in Terminal mode.

Any Key

This command interrupts an issued D (dial) or A (answer) command.

AT

This is the *attention* command and *must* start each modem command (except +++ and A/ commands). It gains the attention of the modem and indicates you are about to give instructions.

BEFORE DIALING

Before dialing another modem, set your communications software to the desired serial port rate. Also, set your modem to the same word length, parity, and Stop bits used by the modem you want to call. Keep in mind, your modem defaults to error control. If the remote modem does not use error control, the Sportster will still try to connect, but without error control.

Serial Port Rate

Setting your software to 57.6K, 38.4K, or 19.2K bps ensures that the Sportster 14,400 can operate at its highest phone line rate of 14.4K bps. The top phone line rate of the Sportster 9600 os 9600 bps, but we still recommend one of the higher serial port rates for best performance.

The modem detects the rate from your typed AT command, operates at that rate at the serial port, and tries to connect with remote modems at 14.4K bps, or its highest connection rate.

Data Format

Both your software and the remote system must use the same 10-bit data format, which always consists of 1 Start bit, plus one of the 9-bit combinations listed in Table 3.1. If you don't know the setup of the remote computer installation, phone ahead to find out what word length, parity and Stop bit combination is required.

Before calling, set your communications software to the required scheme. Some communications programs use a kind of shorthand for formats, such as 7-E-1 or 8-N-1. The modem detects the format from the AT prefix of the next command it receives from your keyboard or from your software.

Table 3.1—Allowable Data Formats

Word Length	Parity (1 Bit)	Stop Bits
7	Even, Odd, Mark, Space	1
7	None	2
8	None	1

Error Control

For reliable high-speed data transfer, always set the Sportster for error control, &M4 (default) or &M5, for calls at speeds over 2400 bps. Most users communicating with V.42- or MNP-compatible modems will want error control at 2400 and 1200 bps, as well.

If you're dialing out and have trouble connecting, it may be because the remote modem doesn't have either V.42 or MNP capability, and it misinterprets your modem's MNP error-control request. If you know the remote modem doesn't support V.42 and MNP, disable MNP handshaking by setting Register S27 to 16 (ATS27=16). The Sportster still connects, but without error control.

To reset the modem for normal operations after the call, issue the ATZ (reset) command, or set Register S27 to zero.

PLACING CALLS

This section discusses commands used in dialing, redialing, and canceling dialing operations.

Dialing	D (0-9 # * , / ; " ! P T W @ R), DS*n*
Redialing	DL, A/
Canceling dialing	<any key>

DIAL (D)

To dial a phone number and place a call without using your software's dialing directory, first put the computer in Terminal mode. Then type the AT and D commands, the number you wish to connect with, and press Enter. Spaces in our command examples are ignored by the modem and are only included for readability.

ATD 1234567 <Enter>

Unless you lowered your modem's speaker volume, you will hear the modem go off hook and dial the telephone number, followed by a series of handshaking signals.

The Dial command string may include up to 40 characters. The modem counts but ignores punctuation characters such as parentheses and hyphens. It does not count spaces, the AT prefix or the carriage return (Enter key) required to execute the command.

The modem also executes any other commands or options included in the command line. The following Dial command example instructs the modem to turn off the speaker (M0), and dial (D) the phone number (1234567) using tone dialing (T). The spaces shown are ignored by the modem and are only included here for readability.

AT M0 DT 1234567 <Enter>

You may want to review the many options on the next several pages that are available for tailoring Dial strings. The most typically used are the Dial Type: Pulse or Tone, and the Pause options—comma, slash and W.

Cancel Dialing

To cancel Dial-command execution, press <any key>. If you inadvertently hit a key on the keyboard while the modem is dialing, the call is canceled. If this occurs, type the A/ command, which re-executes the last command entered. On receipt of A/, the modem redials.

Dial Command Options

When the Dial command is typed, the dial string can be modified according to the needs of the connection. Listed below are options available to you when entering the Dial string.

Dialing Type: Pulse or Tone

The modem defaults to pulse (rotary) dialing. To have the modem use tone dialing, which includes the asterisk (*) and pound sign (#), use the T command.

Dialing type commands may be included in the Dial string (ATDT *number*) or, issued separately (ATT or ATP). However, if you'll always use tone dialing, we recommend writing tone dialing to NVRAM as the modem's default and/or using adaptive dialing, described below.

NOTE: You can switch from one dial type to another within a dialing sequence. Keep in mind that the modem remains set to the last dialing type instruction until it is reset (ATZ command) or it receives a different dial-type command.

Adaptive Dialing (X2 through X4)

When any of the X2 through X4 (default) result code options is in effect and you do not issue a dialing type in the Dial string, the Sportster uses tone dialing, which is faster than the default pulse type. However, if the phone company's central office does not have tone detection equipment, the modem cannot break dial and continues to detect the dial tone. If this occurs, the modem automatically reverts to pulse dialing.

Wait for Another Dial Tone (W)

This command is useful in situations where you must wait for a second dial tone before continuing to dial. For example, if you need to dial for an outside line, as in the following example, the Sportster continues to dial as soon as it detects the next dial tone.

ATD9W1234567 <Enter>

NOTE: This command executes only if result code option X3 or X4 (default) has been issued. If the modem is set to X2 or lower, the modem interprets the W as a comma (two-second pause).

Pause (,)

A comma causes a two-second delay in the dial sequence. The following example contains four-second delays at several points.

ATDP 9,,7654321,,55555,,1 312 1234567 <Enter>

The first four-second pause is to access an outside line after dialing 9, but you may wish to use the W option, just described. The second pause is to make sure the remote system is ready for the user's account number, and the third, to delay before dialing the long-distance number.

Such pauses, however, may not be necessary. Experiment and use delays only as required.

Slash (/)

A slash (/) can be used in any command string to make the modem pause for only 125 milliseconds. Some users find it helpful to have the shorter delay of a series of slashes, rather than the 2-second comma pause.

Dial and Return to Command Mode (;)

If your phone is plugged into the modem, you can use this option to have the modem Auto Dial a telephone rather than a modem. The Sportster dials, remains off hook and returns the OK message, indicating it is in Command mode.

For example, to have the modem place a voice call, enter the Dial command with a semicolon.

ATDT5551234; <Enter>

When the modem returns the OK result, pick up your phone receiver so you can talk to the other party, and send the command that hangs up the modem.

ATH <Enter>

Similarly, you can call a recorded weather or other service. Have the modem Dial, listen to the recording over the modem's speaker and, when you are finished, instruct the modem to hang up.

Dialing Letters (")

Quotation marks are used to make the modem dial abbreviations and acronyms used as phone numbers, such as DIAL USR (the USRobotics Sales Department's 800 number). The option is called Quote mode. Quotation marks are inserted at the beginning of the alphabetic string.

ATDT"BBS NEWS <Enter>

NOTE: If you are including another command after the dial string, use closing quotation marks before the additional command.

Transferring Calls (!)

This command applies to modems in installations where other modems share the phone line. The modem flashes the switchhook, that is, it goes off hook 0.5 seconds, on hook for 0.5 seconds, and off hook again to dial the specified extension. The following example includes instructions to return to Command mode (;) and to hang up (H).

ATDT !1234;H <Enter>

Wait for an Answer (@)

Some online services answer the phone and return a tape-recorded request for information before processing transactions. In such instances, the @ command can be used in the Dial string

to tell the modem to detect at least one ring, wait for five seconds of silence at the other end of the call, and then continue to execute the Dial string.

To use the @ command, set the modem result code option to X3 or X4 (default). If the modem is set to X2 or lower, the modem returns an ERROR message when encountering the @ character in a command string.

In the next example, the modem is set to the X3 result code option and dials a banking service. Each occurrence of @ in the example indicates a five-second wait for silence. That is, for taped requests from the bank for a password (12345), an account number (6789), and a transaction code (2). The transaction code might indicate, for example, a request for an account balance.

ATX3 DT5551234 @ 12345 @ 6789 @ 2 <Enter>

If the necessary conditions do not occur—no rings, or no following five seconds of silence—the modem times out as it normally would (after 60 seconds). It then sends the message NO ANSWER to the screen and aborts the call.

Reversing Originate/Answer Frequencies (R)

This command allows calls to an originate-only modem. That is, a modem set up to send only. It reverses the modem's originate/answer frequencies, forcing the Sportster to dial out at the answer frequency. The command follows the Dial command, before or after the phone number.

AT D1234567R <Enter>
AT DR1234567 <Enter>

Dialing Stored Numbers (DSn)

You can store up to four frequently used telephone numbers in nonvolatile random access memory (NVRAM). See the &Z*n*=s configuration command for instructions for storing telephone numbers.

To dial a stored number, use the DS*n* command, where *n* is the position of the number in NVRAM (0–3). In the first example, the phone number is stored at position 0. (The modem assumes

no *n* parameter means the number is stored at position 0.) In the second, the modem dials the phone number stored at position 3.

ATDS <Enter>
ATDS3 <Enter>

You can also store a partial dial sequence. If you often call a set of phone numbers and only their last three or four digits differ, it might be useful to store the other digits. The following example stores a partial phone number at position 1. Spaces in the command string are included for readability.

AT&Z1 = 1 516 432 <Enter>

Then use the DS*n* command to dial the partial number and have the modem dial the rest of the phone number with the Dial command, as in the following example. Spaces are included for readability.

AT DS1 D5678 <Enter>

Redialing

The most frequent reason for redialing is receipt of a busy signal. The Sportster modem provides two ways of redialing, as follows.

Dial the Last-Dialed Number (DL)

When you want to redial a number, enter the DL command. The modem dials the last-dialed number, which it has stored in a special buffer.

ATDL <Enter>

To display the number stored in the last-dialed buffer, use the following query.

ATDL? <Enter>

To write the last number dialed to NVRAM, use &Z*n*=L where *n* is the position in NVRAM. The following example stores the last-dialed number at position 3.

&Z3=L <Enter>

If a number is already stored at position 3, that number is overwritten with the last-dialed number.

Re-execute the Last Command (A/)

Another option for redialing is to enter the A/ command. This command does not take the AT prefix or a Carriage Return.

A/

When the modem receives a command, it stores it in its command buffer until it receives the next AT command. Note that if you've sent the modem an additional command since the Dial command, A/ repeats that command instead of redialing.

Answering

Unless you do one of the following, your modem will not automatically answer an incoming call, because the Sportster modem is shipped with DIP switch 5 DOWN, Auto Answer suppressed. To set the modem to automatically answer incoming calls, do one of the following.

1. Before powering on the modem, set DIP switch 5 UP. When you turn the modem on, the modem answers incoming calls on the first ring.
2. If the modem is on, use the following command. It instructs the modem to answer on the first ring. (You can substitute a higher value. See the *S-Register Summary* in the Quick Reference Card or Appendix B.)

   ATS0=1 <Enter>

When the modem senses a call coming in, it sends the result code RING to your screen, goes off hook, and sends the remote modem a high-pitched answer tone. If there is no Carrier Detect within 60 seconds, the modem hangs up. If the connection is made, the modem returns a CONNECT result code. When the call is disconnected by you or the remote user, the modem hangs up and returns the NO CARRIER code.

Suppressing Auto Answer

To disable Auto Answer, reverse Steps 1 or 2 above: set DIP switch 5 DOWN before powering on the modem, or set the modem to answer on zero (or no) rings.

ATS0=0 <Enter>

Manual Answer

If you've disabled Auto Answer but are expecting an incoming data call, use the Manual Answer command. Send the modem the following command after the RING result code appears on your screen.

ATA <Enter>

When the call is disconnected, the modem returns to its original state, Auto Answer disabled.

Points to Remember

1. You can set the modem to receive calls when you're not at your computer or terminal. Load your communications software as you normally do, and set the modem to Auto Answer. Also set your software's file-save function to save incoming messages and/or files.

2. If you've attached your phone so it can be used for conventional calls, disable Auto Answer when you are not expecting incoming data calls. Otherwise, your modem may answer the phone before you do, greeting a voice caller with a high-pitched, irritating answer tone.

Disconnecting And Hanging Up

The commands outlined below describe how you can instruct the modem to disconnect the call and hang up the line.

Escape Code Operations (+++)

Once the modem is online to another system, the only command it recognizes is an escape code of three plus symbols that forces

the modem into Online-command mode. Issue the escape command in the following sequence.

- Wait one second after sending the last item of data
- Type: +++
- Wait one second before typing any data

Do not type the AT prefix or a Carriage Return. The guard time of one second before and after prevents the modem from misinterpreting the presence of +++ in the transmitted data stream.

If necessary, the character used in the escape code or the duration of the guard time can be changed by resetting Register S2 or S12. See the *S-Register Summary* in the Quick Reference Card or Appendix B.

Modem Response to +++

When the modem receives +++, by default it enters Online-command mode and returns the OK result code. It maintains the connection and is ready to act on commands. You may then choose one of the following options.

- Issue commands to the modem and then return it online.
- Hang up the modem.

Alternatively, if you want the modem automatically to hang up on receiving the +++ escape code, set S-Register S14 to 1 (ATS14=1). The modem disconnects and sends the NO CARRIER result code to the screen.

Returning Online (On)

After forcing the modem into Online-command mode with the escape code sequence, you can issue commands and then toggle the modem back online with the O command, as in the following example.

AT Q1 O <Enter> [or AT Q1 O0 <Enter>]

O0 Return online (normal).

O1 Return online and retrain. If errors occur during a non-ARQ connection, try this option. The modem returns on-line and requests that both modems resynchronize.

Hanging Up (Hn)

At its default setting, the escape code forces the modem into Online-command mode but leaves the line open. To hang up the modem, issue the following command, with or without the zero, once the modem sends the OK result code.

ATH <Enter> [or ATH0 <Enter>]

H0 Hang up (go on hook).

H1 Go off hook.

Break Handling (&Yn)

This command lets you send a break to abort data transfer without disconnecting from the phone line interface.

&Y0 Destructive, no Break transmitted: the modem clears the data from its transmit buffer (all data is lost) but does not transmit the Break to the remote modem.

&Y1 Destructive, expedited: the modem clears the buffer and immediately sends a Break to the remote modem. Default.

&Y2 Nondestructive, expedited: the modem retains data in the transmit buffer, but immediately sends a Break to the remote modem.

&Y3 Nondestructive, unexpedited (send Break in sequence): the modem transmits any buffer data received before the Break, sends the Break, and then sends any subsequent input from the terminal.

NOTE: If the call is under MNP5 data compression, destructive Breaks cause both modems to reset their data compression tables. When transmission resumes, the modems build new tables, and the result is lower than normal throughput.

INTERNATIONAL CALLS

The following commands apply to international calls.

ITU-T/Bell Answer Sequence (Bn)

To answer international calls, use the default B0 setting.

B0 Default. This setting is required for V.32 *bis* modems to answer V.32 *bis* calls. It also selects the ITU-T V.25.

B1 This setting selects the Bell 2225 Hz answer tone used in the U.S. and Canada and may be used when the remote modem operates at only 2400 bps or lower. Do not use B1 when attempting to connect at 9600 or 14.4K bps.

Guard Tone (&Gn)

The United Kingdom and some Commonwealth countries use phone switching systems that require answering modems to send an 1800 Hz guard tone after they send an answer tone. Some other European phone networks require a 550 Hz guard tone. Guard tones are not used in the United States or Canada.

&G0 No guard tone, U.S./Canada. Default.

&G1 550 Hz guard tone follows answer tone. Requires B0 setting.

&G2 1800 Hz guard tone follows answer tone, United Kingdom and some Commonwealth countries. Requires B0 setting.

Pulse Dial Make/Break Ratio (&Pn)

This command sets the ratio of the off-hook/on-hook (make/break) interval for pulse dialing. The default sets the modem for use in North America. The ratio must be changed if the modem is used to dial out in the United Kingdom and some Commonwealth countries.

&P0 Make/break ratio, U.S./Canada: 39%/61%. Default.

&P1 Make/break ratio, United Kingdom, some Commonwealth countries: 33%/67%.

ITU-T V.21—300 bps

Select this option to call or answer overseas modems at 300 bps. In V.21 mode, the modem answers Bell 103/V.21 calls, but only originates V.21 calls. This option is enabled in Register S27 with the following command.

ATS27=1

ITU-T V.23—1200/75 bps

Some United Kingdom and European systems require a 1200-bps speed with a 75-bps back channel. This option is enabled in Register S34 with the following command.

ATS34=8

CHAPTER 4. SPORTSTER CONFIGURATION

This chapter provides an explanation of the various commands you can use to configure your modem. Many of these functions can be handled by your communications software, but you also have the power to place your computer in Terminal mode and control the modem directly.

The Sportster is preconfigured at the factory so you should be able to connect the modem, set up your communications software appropriately, and be ready to send and receive data. Many users find no need to customize configurations, but should you choose to do so, that option is available with the Sportster. This chapter describes the parameters you can customize to suit your needs and provides instructions for doing so.

NOTE: Settings listed in this chapter as "default" are based on the &F1 template in NVRAM when the modem is shipped.

USING AT COMMANDS

To send commands directly to your modem, first put your modem in Terminal mode. Some communications programs do this automatically upon loading. Others require you to display a communications terminal screen, press a Function key, or perform some other operation. If necessary, refer to the *STOP* guide or your communications software documentation for instructions.

1. Type all commands in either upper case (AT) or lower case (at), but not a combination (At).
2. All commands except A/ (re-execute last command) and +++ (escape code) are preceded by the AT prefix and are executed with the Enter/Carriage Return key (<Enter>).
3. Command string length = 40 characters, maximum. The modem doesn't count the AT prefix, Carriage Return character, or spaces. In a dial string, it counts—but doesn't act on—punctuation such as hyphens and parentheses.

4. A missing numeric parameter is assumed to be zero, as in the command to hang up: ATH <Enter> is the same as ATH0 <Enter>.

FACTORY CONFIGURATION (&Fn AND Yn)

The Sportster is preconfigured at the factory with three permanent &F and two default Y (NVRAM) templates, chosen to optimize your modem's data transfer performance.

Permanent ConfigurationTemplates (&Fn)

The modem is factory shipped with three possible template configurations stored in permanent nonprogrammable read-only memory (ROM). These templates should optimize your data transfer, depending on the system you use. The &F templates are described in detail in Appendix B, but here is a description of each:

&F0 This template is loaded if DIP switch 7 is DOWN when the modem is powered on or reset. The template does not include performance enhancing features, such as a fixed serial port or hardware flow control. What it does offer is compatibility with nontypical systems that cannot handle flow control and other features.

&F1 Default. This template is loaded if DIP switch 7 is UP (factory setting) when the modem is powered on or reset. The template sets the modem to hardware flow control, a fixed serial port rate, the highest level result codes, and the most complete result code set.

The &F1—Hardware Flow Control template is recommended for all IBM-compatible computers, as long as your communications software supports hardware flow control and a fixed serial port.

NOTE: We also recommend that users of Macintosh computers invest in a Hardware Handshaking cable, instead of the standard cable, and use this template.

&F2 This is a software flow control template. We recommend you do not use software flow control and, thus, this template. However, some systems are limited to 3-wire cables that do not support hardware flow control signals. If this is the case, review the warning on software flow control later in this chapter.

To select template &F2—Software Flow Control as your power-on/reset default, enter the following command:

AT&F2&W <Enter>

NOTE: Refer to the *NVRAM Templates* section below for more information on selecting and modifying templates to save as your start-up configurations.

If you need a completely generic template because of data transfer difficulties, flip DIP switch 7 DOWN and reset the modem, or select the &F0—Generic template by entering the following command:

AT&F0 <Enter>

This template allows you to communicate with nontypical systems that cannot handle hardware flow control and other features.

NVRAM Templates (Yn)

In addition to the &F permanent configuration templates, two customizable templates are also provided. Your customizable templates are located in nonvolatile random access memory (NVRAM).

The NVRAM templates are initially loaded with &F template settings when the modem is shipped. When you power on the modem, it checks to see if DIP switch 7 is up or down. The Sportster is shipped with DIP switch 7 UP, indicating the modem should look to the NVRAM template 0 (or Y0) for its power-on/reset default settings.

Initial factory settings are:

Y0 Loads the NVRAM template 0 (factory set at template &F1—Hardware Flow Control). Default.

Y1 Loads the NVRAM template 1 (factory set at template &F2—Software Flow Control).

If you want to switch the power-on/reset default NVRAM template from Y0 to Y1, enter the Y*n* command, then reset the modem with the ATZ command.

AT Y1 Z <Enter>

To customize other defaults you want to store in NVRAM as part of your customized power-on/reset template, use the &W command. You'll find a list of NVRAM options and factory settings in Appendix B.

NOTE: The Y*n* command is unique because, unlike any other AT command, it writes itself to NVRAM—you do not need to use the &W*n* command to write it to NVRAM.

WARNING: The Y*n* command, which selects template settings to use as the start-up/reset default, may select different power-up/reset default settings than those currently loaded. Before typing ATY or ATY1, use option 4 of the Inquiry (I) command to display the current settings.

AT I4 <Enter>

The Y setting on the ATI4 screen indicates if Y0 or Y1 is the power-on/reset default. Use option 5 of the Inquiry command (I) to display the settings in your Y0 and Y1 NVRAM templates.

AT I5 <Enter>

CUSTOMIZING YOUR DEFAULTS (&Wn)

When the modem is shipped, DIP switch 7 is UP, so the modem will read template 0 in NVRAM as the power-up/reset default. The NVRAM template 0 (Y0) is initially loaded with the settings of the &F1 permanent configuration template. Although you cannot alter the &F1 template, you can add, delete, or modify the &F settings stored in your NVRAM templates.

If you want to modify your current configuration settings, use the &Wn command. Possible settings are:

&W0 Modifies the NVRAM 0 template (Y0).

&W1 Modifies the NVRAM 1 template (Y1).

Typically, users prefer the default settings stored in NVRAM when the modem is shipped, but you may select different default settings. For instance, if your system supports hardware flow control, you can set your NVRAM template 1 (or Y1) to reflect the &F1 settings for hardware flow control. (The Y0 template is shipped with hardware flow control settings.)

AT &F1 W1 <Enter>

Likewise, if your system only supports software flow control, you can set your NVRAM template 0 (or Y0) to reflect the &F2 settings for software flow control. (The Y1 template is shipped with software flow control settings.)

AT &F2 W <Enter>

You may also specify the entire configuration in a single command string that ends with the &W*n* command. The following example sets the modem for the current session and stores the configuration in NVRAM 1 (or Y1).

AT X3 &B &H M2 &W1 <Enter>

After sending a configuration to NVRAM, you can change any setting just for the current session, as in the following example. The NVRAM configuration remains intact.

ATX3 <Enter>

But if you want the new setting to be a default, write it to NVRAM at the same time, as in the following example, which saves the setting to NVRAM template 0.

AT X3 &W <Enter>

If you've sent the modem commands to change settings throughout your session and want to save your current configuration, send just the &W*n* command. The current

settings are then written to NVRAM 0 (or Y0) in the example below.

AT&W0 <Enter>

Resetting the Modem (Z)

If you've changed several current settings and want to reset to your power-on defaults, type the following command.

ATZ <Enter>

The modem reads its DIP switch settings and resets to its NVRAM defaults (DIP switch 7 UP) or &F0—Generic template (DIP switch 7 DOWN).

NOTE: Use the ATZ command if you've changed the position of DIP switches 1–7 while the modem is on, so that the modem can read the new settings. The only other way to initiate a new setting for switches 1–7 is to turn the modem off and on again.

Storing Phone Numbers (&Zn=s)

You can store up to four of your most frequently dialed phone numbers in NVRAM. Use the &Z*n*=*s* command, where *s* is the phone number string of the remote modem and *n* is the position of the number (0–3).

The number string may be up to 36 characters long, including Dial command options. The following example stores a phone number at position 0, assumed because no digit immediately follows the &Z. The phone number string below includes the tone-dial (T) and wait for a second dial tone (W) options of the Dial command.

AT&Z=T9W5551234 <Enter>

The following example stores a long-distance number at position 2. We've added spaces for readability.

AT&Z2 = 1 516 555 1234 <Enter>

Use the DS*n* command to dial the stored number. On receipt of the command below, the modem dials the number stored at position 2.

ATDS2 <Enter>

NOTE: Do not include modem settings in the &Z string. If the call requires them, insert them in the command string before the DS*n* command. For example, &K3 (selective data compression) is inserted before the Dial command calling the number stored at position 0.

AT&K3 DS <Enter>

This establishes &K3 as the current setting. To return to default data compression mode after the call, issue the following command.

AT&K1 <Enter>

CHANGING A SETTING

When you change a setting, the modem retains it until you do one of the following.

- Change the setting again.
- Issue the ATZ command to reset the modem.
- Turn the modem off and power it on again.

Error Control (&Mn)

By default, the Sportster first attempts a connection using V.42 (LAPM) error control and, if that doesn't succeed, it attempts an MNP connection. If that doesn't succeed, the modem tries to connect without error control.

Error control is possible at rates of 1200 bps and above. The following options are available.

NOTE: ARQ is USRobotics' term for error control protocols that feature error detection and automatic retransmission of corrupted blocks of data.

&M0 Normal mode, no error control. Because of the nature of phone-line channels, this is never recommended for calls above 2400 bps unless you're using an error-correcting file-transfer protocol.

&M1 Reserved.

&M2 Reserved.

&M3 Reserved.

&M4 Normal/ARQ mode. This setting is the default. If the remote modem doesn't recognize the Sportster's error-control signals—V.42 or MNP—the modem operates in Normal mode, as though it were set to &M0.

&M5 ARQ mode. If the remote modem doesn't recognize the error-control request—V.42 or MNP—the Sportster hangs up.

Auto Answer with Error Control

When set to &M4 or &M5 and a call comes in, the modem goes off hook and responds to received error-control signals. If the Sportster doesn't receive those signals and is set to Normal/ARQ mode (&M4), it answers the call in Normal mode (&M0). If it doesn't receive the signals and is set to ARQ mode (&M5), it hangs up.

Data Compression (&Kn)

When data compression is enabled, the transmitting modem detects redundant units of data and recodes them into shorter units of fewer bits. The receiving modem decompresses the redundant data units before passing them to the receiving computer.

Compression does not occur unless the modems can establish an error-control connection.

If the Sportster makes a V.42 connection, it negotiates V.42 *bis* compression. If V.42 *bis* is not feasible, the connection remains under error control, but without data compression.

If the Sportster makes an MNP connection, it negotiates for MNP Level 5 (MNP5) data compression. If the remote modem does not have MNP5 capability, the connection remains under MNP error control, but without compression.

&K0 Data compression disabled.

&K1 Auto enable/disable. Default. The modem enables compression if the serial port rate is fixed (&B1) and disables compression if the serial port rate follows the connection rate (&B0). (Compression offers no throughput advantage when serial port and connection rates are equal, and may even degrade throughput.)

&K2 Data compression enabled. Use this setting to keep the modem from disabling compression.

&K3 Selective data compression. The modem negotiates only for V.42 *bis* compression, and disables MNP Level 5 (MNP5) compression. See the following note.

NOTE: MNP5 compression is not useful when transferring already compressed files, such as the .ZIP files downloaded from Bulletin Boards and 8-bit binary files that appear already compressed to the modem. MNP5 tends to add data to these files, and throughput over the phone link degrades.

V.42 *bis* compression detects when data is already compressed and turns off until it detects that compression will be advantageous. The special &K3 setting allows the best throughput for already compressed and 8-bit binary files.

Data Rate Commands

The &B*n* and &N*n* commands control data rates at the serial port and phone line interfaces.

The Sportster defaults to a fixed rate at the serial port interface (&B1) to keep the serial port rate higher than the phone link rate. You'll get greater throughput regardless of the connection rate. Your software, however, must support this feature and you must set your software to use a fixed rate.

For the phone line, however, we recommend variable rates (&N0). This lets the modem switch its connection rate to match the rate of a remote modem, no matter what that rate is. If the connection rate is fixed, for example, at 9600 bps (&N6), the modem only connects with modems operating at that rate. Of

course, if your application requires connections with modems at only one rate, you may wish to set the modem to a fixed connection rate.

Software Requirements

Both variable and fixed serial port rates require communications software support. Most communications programs support variable or fixed rates. Check the *STOP* guide or your software manual, especially if your software is a later version than the version in the *STOP* guide. Set your software *before* making calls.

Serial Port Rate (&Bn)

Initially, the modem's serial port rate depends on your software setting. The modem uses the rate at which it receives the AT command to determine the serial port rate, after which it depends on its &B setting.

&B0 Variable serial port rates. The modem switches its serial port rate to follow the connection rate established with a remote modem. If your software has *Auto Baud Detect*, turn it on. The software will switch its serial port rate to match the connection rate.

&B1 Fixed serial port rate. Default. The modem detects its serial port rate from your last AT command and maintains it, whatever the connection rate.

Set your software to 57.6K, 38.4K, or 19.2K bps, then set the modem to &B1 for the best throughput. Some programs require that you turn off *Auto Baud Detect* to fix the serial port rate. Others use the term *Serial Port Lock* (yes or no).

The serial port rate *must equal or exceed* the connection rate. Also, this setting requires flow control, preferably hardware (&H1), to avoid buffer overflow.

&B2 Fixed for ARQ calls/Variable for non-ARQ calls, Answer mode only. When the modem goes off hook and answers in ARQ mode, it shifts its serial port rate to the one

written to NVRAM, for example, 38.4K bps. In non-ARQ mode, it acts as if set to &B0 when answering, and switches its serial port rate to match the call's connection rate.

This option is designed for installations such as Bulletin Boards that receive calls from a wide variety of modems, ranging from the very slow to those with the Sportster 's advanced design.

Connection Rate (&Nn)

Use the N*n* command to select variable or fixed rates at the phone line interface. Variable rates let the modem connect with a variety of remote modems, while fixed rates limit calls to one connection rate.

&N0 Variable rates. Default. The Sportster negotiates with the remote modem for the highest possible connection rate, depending on the capabilities of the remote modem. This is the recommended setting.

&N 1–8 Fixed rate. The Sportster only connects if the remote modem is operating at the same rate. If not, the Sportster hangs up.

The fixed rate options are as follows.

&N1	300 bps	&N2	1200 bps
&N3	2400 bps	&N4	4800 bps
&N6	9600 bps		

Sportster 14,400 only:

&N5	7200 bps
&N7	12K bps
&N8	14.4K bps

By fixing the connection rate, you can filter out calls at other than a specific rate, for security or other reasons.

RS-232 Operations

The parameters described below are directly affected by the RS-232 connection and DIP switch settings.

Carrier Detect (&Cn)

Like DIP switch 6, this command controls Carrier Detect (CD) signaling from the modem to the computer. The modem is factory set for normal operations with DIP switch 6 UP (which means the override is disabled for normal CD operations).

Check the *STOP* guide or your communications software manual to find the required setting. If you want to change CD operations during a session, use this command.

&C0 CD override, CD always ON.

&C1 Normal CD operations. The modem sends a signal when connecting with another modem and drops CD upon disconnecting. Most communications software requires this setting.

Data Terminal Ready (&Dn)

Like DIP switch 1, this command controls the Data Terminal Ready (DTR) signaling from the computer to the modem. The modem is factory set for normal operations with DIP switch 1 UP (which means the override is disabled) with &C for normal DTR operation.

Check the *STOP* guide or your communications software manual to find the required setting. If you want to change DTR operations during a session, use this command.

&D0 DTR override, modem ignores DTR

&D1 Reserved.

&D2 Normal DTR operations. The computer or terminal must send a DTR signal or the modem won't accept commands. Dropping DTR terminates a call. Most communications software requires this setting.

Data Set Ready (&Sn)

The modem sends your computer a Data Set Ready (DSR) signal. (Data Set is industry jargon for modem.) Few, if any, commercial communications programs require the modem to control DSR, &S1. Leave the modem set for DSR overridden, &S0, unless you know that your installation requires a different setting.

&S0 DSR is always ON (override). Default.

&S1 In Originate mode, the modem sends DSR after dialing, when it detects the remote modem's answer tone. In Answer mode, it sends DSR after sending an answer tone.

Flow Control

The modem uses either hardware or software flow control to manage the amount of data stored in the buffers, thus preventing buffer overflow.

The Sportster defaults to hardware flow control. This type of flow control is performed between the modem and computer with RS-232 signaling.

Software flow control uses the standard ASCII Transmit OFF (XOFF) character, Ctrl-S, and the Transmit ON (XON) character, Ctrl-Q.

ASCII definitions are as follows.

XON	Ctrl-Q	ASCII 17 Decimal, 11 Hex
XOFF	Ctrl-S	ASCII 19 Decimal, 13 Hex

The ASCII definitions of these characters may be user-defined; see Registers S22 and S23 in Appendix B. That appendix also includes an ASCII chart.

NOTE: Both your software and computer must support the flow control you select. All 100% IBM PC-compatible computer support hardware flow control, as do Apple computers equipped with a Hardware Handshaking cable. However, hardware flow control requires software support. Refer to the

STOP guide or your software documentation to see what your software supports.

When you have determined the type of flow control your system supports, be sure to set your software appropriately *before* transferring files.

Warning on Software Flow Control

In ordinary operations, the only characters the modem recognizes during a call are the three plus symbols (+++) of the escape code that returns it to command mode. But when software flow control is enabled, the modem or terminal also looks for Ctrl-S or Ctrl-Q characters. *If these characters occur in a file or as part of a protocol*, it reads them as XON/XOFF characters and acts on them.

For example, XON/XOFF characters occur in binary files, and are used by Xmodem-type protocols. They may also come from the remote system: an XON from the remote system, after your modem has sent an XOFF, can result in buffer overflow.

Software flow control may prove satisfactory if you're only transferring text files; however, you may lose data if XON/XOFF characters occur in the data stream from other sources.

To select software flow control, write the &F2 configuration template to Y1.

AT &F2 &W

Software Flow Control Precautions

If you can't use hardware flow control and are doing Xmodem-type protocol or binary file transfers, select a protocol that performs error correction, and turn off the modem's error control (AT&M0).

Transmit Data Flow Control (&Hn)

This type of flow control regulates data your computer transmits to the modem for transmission over the phone link. The modem monitors its Transmit Data buffer as data comes in. If the buffer nears 90% capacity, the modem signals the computer to stop transmitting. When it has sent enough data over the link to half-empty the buffer, it signals the computer to resume transmitting.

When it is Required

Transmit Data flow control should be enabled in the following situations.

- You're using error control (any allowable rate above 300 bps), with or without data compression. If data is resent due to errors, a continuous stream of data from the computer could overflow the modem's buffer.
- The serial port rate is higher than the connection rate, for example, the serial port rate is 38.4K bps and the connection rate is 14.4K bps.

NOTE: Set your software to either hardware or software flow control. Some programs also require that you turn off the type you are not using.

&H0 Transmit Data flow control disabled.

&H1 Hardware flow control. Default. Your computer and software must support Clear to Send (CTS). The modem drops the Clear to Send (CTS) signal to the computer when its buffer nears 90% capacity, and starts sending CTS again when the buffer is about half full.

&H2 Software flow control. Your software must support XON/XOFF signaling. The modem sends an XOFF to the terminal when its buffer nears 90% capacity, and sends an XON when the buffer is about half full. Default in the &F2—Software Flow Control template.

&H3 Use both hardware and software flow control. Select this option if you're not sure what your computer supports.

NOTE: If possible, use hardware flow control. See the *Warning on Software Flow Control*, earlier in this chapter for details.

Received Data Flow Control

Two commands control the flow of received data. &R*n* (hardware) and &I*n* (software) control the flow of Received Data passed by the modem to your computer. Because computers handle incoming data more quickly than the modem receives it over the phone line, most applications won't need this.

Hardware Control (&Rn)

When your computer drops its Request to Send (RTS) signal, the modem stops passing along received data. The computer sends RTS again when it is ready to receive more data.

Your computer and software must support RTS. You cannot use this type of flow control, however, if your software requires a constant RTS signal.

NOTE: Use only for ARQ (error-control) calls, because the V.42 and MNP protocols control the data flow across the phone link. During non-ARQ calls, however, there is no way to signal the remote modem to stop sending data. If your modem stops passing data to your computer and the remote modem keeps sending, the Received Data buffer will overflow.

&R0 Reserved.

&R1 The modem ignores Request to Send (RTS). This setting is required if your software does not support RTS.

&R2 Hardware flow control of received data enabled. Default. The modem passes received data to your computer only on receipt of the RTS signal.

Software Control (&In)

When you send the modem a Ctrl-S (XOFF) command from the keyboard, the modem stops passing received data to your

computer. When you send a Ctrl-Q (XON) command, it resumes.

NOTE: Because of the risk of data loss, &I1–5 are recommended only if your data does not have XON/XOFF control characters. See *Warning on Software Flow Control* for details.

&I0 Disables XON/XOFF flow control of received data. Recommended for non-ARQ calls.

&I1 The modem acts on your typed Ctrl-S/Ctrl-Q commands and passes them to the remote computer. Not recommended for non-ARQ calls. Use in ARQ mode only, but keep in mind that XON/XOFF characters sent to the remote computer may interfere with XON/XOFF signaling between it and the remote modem. &I2 is preferred for ARQ calls.

&I2 The modem acts on your XON/XOFF commands, but removes them before sending data to the remote computer. Default in the &F2—Software Flow Control template. Recommended setting for ARQ mode, only. It ensures that the remote computer does not confuse its modem's XON/XOFF characters with yours.

If the call is not in ARQ mode, there is no flow control on the phone link. If you send an XOFF to your modem and it stops passing data, it has no way to tell the remote computer and modem to stop sending for a while, and your modem's buffer may overflow. See &I5 for another alternative.

&I3 Host Mode. Applies only to modems attached to HP mainframes using the ENQ/ACK protocol. ARQ mode only.

&I4 Terminal Mode. Applies only to modems attached to HP system terminals using the ENQ/ACK protocol. ARQ mode only.

&I5 Enables phone link flow control when the connection is not under error control. Both modems must use &I5. In ARQ mode, the modem operates as if set to &I2. It acts on

XON/XOFF commands, but does not pass them on to the remote system.

In non-ARQ mode, the modem acts as if set to &I0. It does not look for local XON/OFF commands, but does look for any XON/XOFF characters coming in over the phone link from the remote computer. The modem acts upon them and drops them from the data stream.

Operators can signal the other modem to stop sending and control phone link data flow to keep their modem's buffer from overflowing, if both are set to &I5.

Result Codes

Four commands control the result codes that the modem returns to the screen.

V*n*	Numeric/verbal response mode
Q*n*	Display/suppress all result codes
X*n*	Result code options
&A*n*	Display/suppress additional result code options

Response Modes (Vn)

Result codes are sent to the screen in words (Verbal mode) or numbers (Numeric mode). The modem is factory set to Verbal mode when powered on (DIP switch 2 is UP). Use the V*n* command to select verbal or numeric result codes for a current session, independently of the DIP switch setting.

At power-on and reset, the modem operates according to the DIP switch setting. The V*n* command is not stored in nonvolatile memory as a power-on/reset default.

V0 *Numeric mode.* Numeric result codes are followed by a Carriage Return but no Line Feed, as in the following example, where a 3 is returned (for NO CARRIER).

ATD1234567 <Enter>
becomes
3TD1234567 <Enter>

V1 *Verbal mode.* Verbal responses are preceded and followed by a Carriage Return and a Line Feed, as shown below.

ATD1234567 <Enter>
NO CARRIER

Quiet Mode (Qn)

Enable/suppress the display of result codes. The Sportster modem is shipped with DIP switch 3 DOWN, to display result codes. Use the *Qn* command to control the display for a current session, independent of the switch setting.

At power-on and reset, the modem operates according to the DIP switch setting. The *Qn* command is not stored in non-volatile memory as a power-on/reset default.

Q0 Result codes are displayed.

Q1 Result codes are suppressed (made quiet).

Q2 Result codes are suppressed only in Answer mode.

Result Code Options (Xn)

You have five options, X0 through X4, for selecting the result code set best suited to your applications, as shown in Table 4.1. Definitions are listed in Table 4.2.

X0 Basic set, returns the first five codes (0–4) in the following table.

X1 Extended set, codes 0–5, 10, 13 and 18, that adds rate-specific CONNECT messages to the Basic set. This set also includes all &A result codes.

X2-4 The default is X4. These options include the X1 set, call-progress codes 6 or 7, and 8, and the functions listed in the following table.

NOTE: By default, the modem is also set to &A3, which selects additional results that report the protocols used in the connection. Descriptions follow in Tables 4.1 and 4.2.

Table 4.1—Result Code Options

	Setting				
Result Codes	**X0**	**X1**	**X2**	**X3**	**X4**
0/OK	•	•	•	•	•
1/CONNECT	•	•	•	•	•
2/RING	•	•	•	•	•
3/NO CARRIER	•	•	•	•	•
4/ERROR	•	•	•	•	•
5/CONNECT 1200		•	•	•	•
6/NO DIAL TONE			•		•
7/BUSY				•	•
8/NO ANSWER				•	•
10/CONNECT 2400		•	•	•	•
13/CONNECT 9600		•	•	•	•
18/CONNECT 4800		•	•	•	•
20/CONNECT 7200		•	•	•	•
21/CONNECT 12000		•	•	•	•
25/CONNECT 14400		•	•	•	•
Functions					
Adaptive Dialing			•	•	•
Wait for 2nd Dial Tone (W)				•	•
Wait for Answer (@)				•	•
Fast Dial			•		•

NOTE: More CONNECT messages indicate an error-control connection, the modulation for a call, or the error control and data compression used. See *Additional Result Code Options* (&A*n*), after this section.

Table 4.2—Result Code Definitions

Result Code	Meaning
0/OK	Command has been executed.
1/CONNECT	Connection established with another modem; if set to X0, connection may be at 300, 1200, 2400, 7200, 9600, 12K or 14.4K bps; if X1 or higher, connection is at 300 bps.
2/RING	Incoming ring detected.
3/NO CARRIER	Carrier detect has failed or carrier has been dropped due to disconnect.
4/ERROR	Command is invalid.
5/CONNECT 1200	Connection established with another modem at 1200 bps.
6/NO DIAL TONE	Dial tone not detected during the normal 2 seconds, set in Register S6.
7/BUSY	Busy signal detect; modem hangs up.
8/NO ANSWER	After waiting 5 seconds for an answer, modem hangs up; returned instead of NO CARRIER when the @ option is used.
10/CONNECT 2400	Connection established with another modem at 2400 bps.
13/CONNECT 9600	Connection established at reported rate. Same meaning for results of 4800 (18), 7200 (20), 12K (21) and 14.4K (25) bps.
Adaptive Dialing	The modem attempts to use tone dialing and, if that doesn't work on the line, reverts to rotary (pulse) dialing.
Wait for Another Dial Tone (W)	The modem continues dialing as soon as it detects another dial tone. See the dial options in Chapter 3.
Wait for an Answer (@)	The modem continues dialing when it detects 5 seconds of silence on the line. See the dial options in Chapter 3.
Fast Dial	The modem dials immediately on dial-tone detect, instead of waiting the normal 2 seconds set in Register S6. See *S-Registers* in Appendix B.

Additional Result Code Options (&An)

Use this command to enable/disable one of the following sets of error control, modulation, or protocol result codes.

If you encounter software problems, it may be because your software expects to find different result codes from those the modem is sending. (The modem defaults to &A3.) Review your software documentation or try &A2, &A1, or &A0. You may need to call your software's technical support to find out which &A sets they support.

&A0 ARQ (error-control) codes are disabled. This setting does not affect an error-control connection; the modem returns standard CONNECT messages if result codes are enabled.

&A1 ARQ codes are enabled. Default. One of the results below is shown when a successful error-control connection is established. CONNECT/ARQ is displayed if the modem is set to X0 and the connection is between 1200 to 14.4K bps. The remaining results indicate connection rate and require X1 (default) or above. If your software cannot handle the ARQ codes, select &A0.

14/CONNECT/ARQ	19/CONNECT 4800/ARQ
15/CONNECT 1200/ARQ	24/CONNECT 7200/ARQ
16/CONNECT 2400/ARQ	22/CONNECT 12000/ARQ
17/CONNECT 9600/ARQ	26/CONNECT 14400/ARQ

&A2 V32 modulation codes are enabled. These results require a setting of X1 or higher. If your software cannot handle the added modulation information, select &A1 or &A0.

33/CONNECT 9600/V32	41/CONNECT 12000/V32
37/CONNECT 9600/ARQ/V32	42/CONNECT 12000/ARQ/V32
38/CONNECT 4800/V32	44/CONNECT 7200/ARQ/V32
39/CONNECT 4800/ARQ/V32	45/CONNECT 14400/V32
40/CONNECT 7200/V32	46/CONNECT 14400/ARQ/V32

&A3 Protocol codes are enabled. Default. Error-control protocols reported are LAPM or MNP. When the call is not under one of those protocols (and ARQ is not included in the result code), the modem reports NONE, for no protocol.

If the modems are using data compression, the type of compression—V42BIS or MNP5—is added to the result code. In the first of the following examples, the modems negotiated error control for the call (ARQ), used V.32 *bis* modulation, are using the LAPM error-control protocol, and are using V.42 *bis* compression.

CONNECT 14400/ARQ/V32/LAPM/V42BIS [or MNP/MNP5]
CONNECT 2400/ARQ/MNP/MNP5 [or LAPM/V42BIS]
CONNECT 2400/NONE

If your software cannot handle the added protocol information, select &A2, &A1 or &A0.

Although these codes will return numeric identifiers if DIP switch 2 is DOWN or you've set the modem to V0, they are the same numeric identifiers used for &A2 result codes. If you want &A3 protocol indicators, use Verbal mode (V1), and not Numeric mode (V0).

Audio Monitor

The modem's speaker enables you to monitor the dial-connect process. There are several ways to make use of this feature. After the Sportster modem dials a number, it waits up to 60 seconds for a high-pitched answer tone from the other modem, immediately followed by data signals, called a *carrier*. These signals must occur before a data link is established.

At the default X4 setting, the modem sends your screen the NO CARRIER message after 60 seconds. If you listen to the speaker, you can respond immediately, instead of waiting for the modem to time out, by pressing any key on the keyboard. This cancels the call.

You can also hear if dialing is proceeding too quickly for the system. Terminate the call (press any key) and retype the Dial command, but insert a comma (,) or a couple of slashes (/), to have the modem pause during the dialing process.

Speaker Control (Mn)

This command disables the speaker entirely or sets the speaker to monitor different segments of the dial-connect sequence.

M0 Disables the speaker entirely so that you don't hear the modem go off hook, dial, etc.

M1 The speaker is ON until Carrier Detect. Default. You can monitor call progress until the Sportster detects the remote modem's carrier signals, or until the 60-second timeout and result code display. At Carrier Detect, the modem disconnects the speaker and data transmission sounds are suppressed.

M2 The speaker is ON continuously, including during data transmission.

M3 The speaker doesn't go ON until after the last digit is dialed, then goes OFF at Carrier Detect.

Local Echo

Local echo is the display of what you type at the keyboard and data the Sportster transmits to another modem. The E*n* command controls the display of your typed commands, when the Sportster is in Command mode. The F*n* command applies when your modem is online to another system.

Command Mode Local Echo (En)

The Sportster modem is shipped with DIP switch 4 UP, enabling local echo. The E*n* command controls the local echo for a current session, independent of the switch setting. At power-on and reset, the modem operates according to the DIP switch setting.

The E*n* command is not stored in nonvolatile memory as a power-on/reset default.

E0 Command Mode echo OFF. The modem does not display keyboard commands.

E1 Command Mode echo ON.

NOTE: If double characters appear on the screen, both the modem's local echo and your software's local echo are on.

Online Local Echo (Fn)

This command causes the modem to display a copy of the data it is transmitting to another system. Many systems, however, return a copy of received data, which is called a remote echo. If the modem's online echo is ON and there is also remote echoing, double characters appear on the screen.

In some microcomputer documentation, the term *duplex* is applied to local online echoing, although the term is not technically accurate.

F0 Online echo ON. Sometimes called *half duplex*. As the modem transmits data to a remote system, it also sends a copy of the data to the screen.

F1 Online echo OFF. Sometimes called *full duplex*. Default.

S-Registers

The S-Registers are used to set various timing parameters, redefinition of selected ASCII characters, and other configuration options. The defaults reflect typical requirements. Use the ATS command to change an S-Register setting.

Users typically require the default values. To change a setting, use the ATS*r*=*n* command, where *r* is the register and *n* is a decimal value from 0–255 (unless otherwise indicated).

The example below sets the modem's test timer to 10 seconds.

ATS18=10 <Enter>

The modem does not perform a value-range check. Some values you select may not work with some equipment, and you'll have to readjust the settings.

Use ATS*r*? to display the contents of a register, as follows.

ATS20? <Enter>

A summary of the S-Register functions is in Appendix B and the Quick-Reference Card .

CHAPTER 5. INQUIRIES AND HELP SCREENS

This chapter provides an explanation of the various commands you can use to inquire on status and obtain Help screens to view current settings.

INQUIRIES (In)

The Inquiry command has eight options. The most commonly used options display the following information.

ATI4	Current settings
ATI5	NVRAM settings
ATI6	Link diagnostics

I0 The modem returns a product code. If you have a problem and call USRobotics' Technical Support Department, you may be asked for this product code.

I1 The modem performs a checksum of its read-only memory (ROM) and returns the result to the screen. This function is used only in factory testing. The modem should always read the same number.

I2 The modem performs a test of its random access memory (RAM) and returns either the OK (0) or ERROR (4) result code, followed by OK when the test is completed. You may want to use this command as a checkpoint if the modem appears to be malfunctioning.

I3 Reserved.

I4 The modem displays its current configuration. Figure 5.1 on the following page is an example.

```
ati4

USRobotics Sportster 14400 Fax Settings...

   B0  E1  F1  M1  Q0  V1  X4  Y0
   BAUD=19200  PARITY=N  WORDLEN=8
   DIAL=PULSE  ON HOOK

   &A3  &B1  &C1  &D2  &G0  &H1  &I0  &K0
   &M4  &N0  &P0  &R2  &S0  &T5  &Y1

   S00=001  S01=000  S02=043  S03=013  S04=010  S05=008  S06=002
   S07=060  S08=002  S09=006  S10=007  S11=070  S12=050  S13=000
   S14=001  S15=000  S16=000  S17=000  S18=000  S19=000  S20=000
   S21=010  S22=017  S23=019  S24=000  S25=005  S26=000  S27=000
   S28=008  S29=020  S30=000  S31=000  S32=000  S33=000  S34=006
   S35=000  S36=014  S37=000  S38=000  S39=000  S40=000  S41=000
   S42=000  S43=000  S44=015  S45=000  S46=000  S47=000  S48=000
   S49=000  S50=000  S51=000

   LAST DIALED #:

OK
```

Figure 5.1—Sample Current Settings Screen

I5 The modem displays the configuration stored in nonvolatile random access memory (NVRAM), as in the following example. A second screen, activated by pressing any key, shows the Y1 template and your four stored telephone numbers.

```
ati5

USRobotics Sportster 14400 Fax NVRAM Settings...

 Template Y0

   DIAL=PULSE  B0  F1  M1  X4
   BAUD=19200    PARITY=N   WORDLEN=8

   &A3  &B1  &C1  &D2  &G0  &H1  &I0  &K0
   &M4  &N0  &P0  &R2  &S0  &T5  &Y1

 S00=001  S02=043  S03=013  S04=010  S05=008  S06=002  S07=060
 S08=002  S09=006  S10=007  S11=070  S12=050  S13=000  S14=000
 S15=000  S19=000  S21=010  S22=017  S23=019  S24=000  S25=005
 S26=000  S27=000  S28=008  S29=020  S31=000  S32=000  S33=000
 S34=006  S35=000  S36=014  S37=000  S38=000  S41=000  S42=000
 S43=000  S44=015  S51=000

Strike any key when ready. . .
```

Figure 5.2—Sample NVRAM Settings Screen

I6 During a connection, the modem monitors and stores information about link operations. When the call is ended, you can request a diagnostic summary, as in the following example.

```
ati6

USRobotics Sportster 14400 Fax Link Diagnostics...

Chars sent                0          Chars Received            0
Chars lost                0
Octets sent               0          Octets Received           0
Blocks sent               0          Blocks Received           0
Blocks resent             0

Retrains Requested        0          Retrains Granted          0
Line Reversals            0          Blers                     0
Link Timeouts             0          Link Naks                 0

Data Compression     NONE
Equalization         LONG
Fallback             Disabled
Last Call            00:00:00

No Connection
OK
```

Figure 5.3—Sample Link Diagnostics Screen (ATI6)

For calls under data compression, the number of characters sent may be less than the number of octets sent, due to buffering operations.

Most terms used in the display are self explanatory except for the following:

Octets: Compressed data units. If the number of octets is greater than the number of characters sent, the modems probably used MNP5 compression on an already compressed file, and the result was expanded data.

Blers: Errors in data and protocol blocks. If there were many block errors, your receiver may have experienced problems on the line.

Blocks Resent: These represent blocks the remote modem resent due to the previous category, *Blers*.

Link Timeouts: Protocol detection problems: communications were severed momentarily and the modems probably recovered. This does not indicate the retry timeout.

Link Naks: Negative acknowledgments (one or more blocks).

Data Compression: Indicates the type of data compression negotiated for the call (V42BIS or MNP5) or NONE. A V42BIS response includes the size of the dictionary and the maximum string length used, for example, 2048/32. See Appendix A for more information.

Fallback: Enabled/Disabled: indicates whether or not the modems negotiated online fallback during the connection sequence.

Protocol: Indicates the error control protocol negotiated (LAPM, MNP, NONE).

Speed: The last rates at which the receiver/transmitter were operating before disconnecting.

Disconnect Reason: Possible reasons the modem hung up are as follows:

- *DTR dropped*—The DTE dropped the Data Terminal Ready signal, terminating the call.
- *Escape code*—The operator sent the modem the +++ escape code.
- *Loss of carrier*—The modem detected loss of the remote modem's carrier and waited the duration specified in Register S10 (default is 0.7 seconds).
- *Inactivity timeout*—The modem detected no activity on the line for the duration specified in Register S19 (default is 0, timer disabled).
- *MNP incompatibility*—The modem is set to &M5 and the remote modem does not have MNP compatibility, or there was an MNP negotiation procedure error.
- *Retransmit limit*—The modems reached the maximum of 12 attempts to transfer a data frame without error.

- *LD received*—The remote modem sent an MNP error control Link Disconnect request.
- *DISC*—The remote modem sent a V.42 Disconnect frame.
- *Loop loss disconnect*—The modem detected a loss of current on the loop connecting it with the telephone company central office. This usually occurs because the remote modem has hung up: the central office drops current momentarily when there is a disconnect at the other end of a call. Unless Register S38 is set higher than 0, the modem immediately hangs up at loop loss.
- *Unable to retrain*—After several attempts, disturbances on the phone line prevented the modems from retraining, and they could no longer transmit or receive data.
- *Invalid speed*—The modem is set to &N1 or higher, for a fixed link rate, and the remote modem is not operating at the same rate.
- *XID timeout*—The modems failed to negotiate the V.42 Detection (XID Exchange) phase.
- *SABME timeout*—(Set Asynchronous Balance Mode Extended): The modems failed this part of V.42 link negotiation.
- *Break timeout*—Incompatible processing of a Break signal occurred.
- *Invalid codeword*—The modem received an invalid V.42 *bis* (compression) frame.
- *A rootless tree*—The modem received an invalid V.42 *bis* (compression) frame.
- *Illegal command code*—The modem received an invalid V.42 *bis* (compression) frame.
- *Extra stepup*—The modem received an invalid V.42 *bis* (compression) frame.

I7 The modem returns a product configuration. If you have a problem and call USRobotics' Technical Support staff, you may be asked to read this screen.

S-Register Query (Sr?)

This command allows you to view the contents of a particular S-Register, as in the following example that requests the contents of Register S0 ("On what ring will the modem answer?").

ATS0? <Enter>

Stored Phone Number Query (&Zn?)

At this command, the modem returns the phone number stored in NVRAM at position *n*, as in the following example that includes a sample modem response.

AT&Z3? <Enter>
5551234

Last-Dialed Number Inquiry (DL?)

At this command the modem displays the number stored in the last-dialed number buffer.

ATDL?

HELP SCREENS

Sportster modems provide four Help screens: summaries of the basic AT command set, extended ampersand (&) command set, Dial command options, and S-Register functions.

Stop/Restart Display

The following command stops the display. Hold down the Control key and type "S".

<Ctrl>-S

To restart the display, use the same command or press <any key>.

Cancel Display

Either of the following commands cancels the display.

<Ctrl>-C
<Ctrl>-K

Basic Command Set ($)

At AT$, the Sportster displays a screen that shows a partial summary of the command set. A second screen, activated by pressing any key, shows the remaining commands. The first screen is shown in Figure 5.4.

```
at$
HELP,  Command Quick Reference (CTRL-S to Stop, CTRL-C to Cancel)

&$    HELP, Ampersand Commands          Mn    n=0  Speaker Off
A/    Repeat Last Command                     n=1  Speaker On Until CD
AT    Command Mode Prefix                     n=2  Speaker Always On
A     Answer Call                             n=3  Speaker Off During Dial
Bn    n=0  V32 Mode/CCITT Answer Seq On       n=0  Return Online
      n=1  Bell Answer Seq                    n=1  Return Online & Retrain
Dn    Dial a Telephone Number                 n=2  Return Online & Speed Shift
      n=0..9#*TPR,;"W@!()-              P     Pulse Dial
DS    Dial Stored Phone Number          Qn    n=0  Result Codes Sent
D$    HELP, Dial Commands                     n=1  Quiet (No Result Codes)
En    n=0  No Command Echo                    n=2  Verbose/Quiet On Answer
      n=1  Echo Command Chars           Sr=n  Sets Register "r" to "n"
Fn    n=0  Online Echo                  Sr?   Query Register "r"
      n=1  No Online Echo               S$    HELP, S Registers
Hn    n=0  On Hook (Hang Up)            T     Tone Dial
      n=1  Off Hook                     Vn    n=0  Numeric Responses
In    n=0  Product Code                       n=1  Verbal Responses
      n=1  Checksum                     Xn    n=0  Basic Result Codes
      n=2  RAM Test                           n=1  Extended Result Codes
Strike a key when ready . . .
```

Figure 5.4—Sample Basic Commands HELP Screen

Ampersand Command Set (&$)

At AT&$, the Sportster displays a screen that shows a partial summary of the extended ampersand command set. A second screen, activated by pressing any key, shows the remaining command set. The first screen is shown in Figure 5.5.

```
at&$
HELP, Ampersand Commands (CTRL-S to Stop, CTRL-C to Cancel)

&An    n=0  Disable /ARQ Result Codes    &Pn   n=0  N.American Pulse Dial
       n=1  Enable /ARQ Result Codes            n=1  UK Pulse Dial
       n=2  Enable /Modulation Codes     &Rn   n=1  Ignore RTS
       n=3  Enable /Extra Result Codes          n=2  RX to DTE/RTS high
&Bn    n=0  Floating DTE Speed           &Sn   n=0  DSR Always On
       n=1  Fixed DTE Speed                     n=1  Modem Controls DSR
       n=2  DTE Speed Fixed When ARQ     &Tn   n=0  End Test
&F     Load Factory Configuration               n=1  Analog Loopback (ALB)
&Gn    n=0  No Guard Tone                       n=3  Digital Loopback (DLB)
       n=1  550 Hz Guard Tone                   n=4  Grant Remote DLB
       n=2  1800 Hz Guard Tone                  n=5  Deny Remote DLB
&Hn    n=0  Disable TX Flow Control             n=6  Remote Digital Loopback
       n=1  CTS                                 n=7  Remote DLB With Self Test
       n=2  Xon/Xoff                            n=8  ALB With Self Test
       n=3  CTS and Xon/Xoff             &W    Store Configuration
&In    n=0  Disable RX Flow Control      &Yn   n=0  Destructive
       n=1  Xon/Xoff                            n=1  Destructive/Expedited
       n=2  Xon/Xoff Chars Filtered             n=2  Nondest./Expedited
&Kn    n=0  Disable Data Compression            n=3  Nondest./Unexpedited
Strike a key when ready . . .
```

Figure 5.5—Sample Ampersand Commands HELP Screen

Dialing (D$)

At ATD$, the Sportster displays the Dial command summary.

```
atd$
HELP, Dial Commands (CTRL-S to Stop, CTRL-C to Cancel)

0-9 Digits to Dial
*   Auxiliary Tone Dial Digit
#   Auxiliary Tone Dial Digit
T   Tone Dialing
P   Pulse Dialing
R   Call an Originate Only Modem
,   Pause (Wait for S8 Time)
;   Remain in Command Mode After Dialing
"   Used to Dial Alpha Phone #'s
W   Wait for 2nd Dial Tone (X3-X4)
@   Wait for an Answer (X3-X4)
!   Flash Switch Hook

OK
```

Figure 5.6—Sample Dial Command HELP Screen

S-Register Functions (S$)

At ATS$, the Sportster displays a screen that shows a partial summary of the S-Register functions. A second screen, activated by pressing any key, shows the remaining registers. The first screen is as follows.

```
ats$
HELP, S Register Functions (CTRL-S to Stop, CTRL-C to Cancel)

S0  Ring to Answer On                S19 Inactivity Timeout (min)
S1  Counts # of Rings                S20 Reserved
S2  Escape Code Char                 S21 Break Length (1/100sec)
S3  Carriage Return Char             S22 Xon Char
S4  Line Feed Char                   S23 Xoff Char
S5  Backspace Char                   S24 Reserved
S6  Wait Time/Dial Tone (sec)        S25 DTR Recognition Time (1/100sec)
S7  Wait Time/Carrier (sec)          S26 Reserved
S8  Comma Time (sec)                 S27 Bit Mapped
S9  Carrier Detect Time (1/10sec)          1 = V21 Mode
S10 Carrier Loss Time (1/10sec)            2 = Disable TCM
S11 Dial Tone Spacing (msec)              16 = Disable MNP Handshake
S12 Escape Code Time (1/50sec)            32 = Disable V.42
S13 Bit Mapped                            48 = Disable V.42 Detect Phase
      1 = Reset On DTR Loss          S28 V32 Handshake Time (1/10sec)
      8 = Do DS On DTR               S29 Reserved
     16 = Do DS On Reset             S30 Reserved
     64 = Disable MNP Level 3        S31 Reserved
S14 Bit Mapped                       S32 Reserved
Strike a key when ready . . .
```

Figure 5.7—Sample S-Register HELP Screen

APPENDIX A. DATA COMMUNICATIONS IN ACTION

This appendix includes detailed information on how Sportster modems use error control and, especially useful, some statistics and guidelines on using the modem for the best throughput.

ERROR CONTROL AND THROUGHPUT OVERVIEW

Error control protects the integrity of data transferred over phone channels and is available for calls at 1200 bps and above. It can be disabled, although high-speed calls (above 2400 bps) should always be under error control. The operations defined in an error control protocol include the following.

- Establishment of compatibility
- Data formatting into blocks
- Error detection through Cyclic Redundancy Checking (CRC)
- Positive acknowledgment of error-free blocks and negative acknowledgment of corrupted data blocks
- Retransmission of corrupted data blocks

The Sportster is set at the factory to &M4, causing it to try for an error-control connection and, if that isn't possible, to proceed with the call in Normal mode. The modem first tries for a V.42 connection, then an MNP connection. The information below is based on the Sportster's setting of &M4.

ITU-T V.42 HANDSHAKING

The exchange of signals between two devices in order to establish a communications link is called handshaking. ITU-T V.42 includes a two-stage handshaking process.

- A Detection phase that is based on an exchange of predefined characters.

- LAPM (Link Access Procedures for Modems) Negotiation. In this phase, the modems identify their capabilities concerning maximum data block size and the number of outstanding data blocks allowed before an acknowledgment is required.

MNP HANDSHAKING

This protocol is supported by the ITU-T V.42 Recommendation. It was originally developed by Microcom, Inc., and is now in the public domain.

MNP handshaking begins with an MNP Link Request sent by the calling modem. If the remote modem doesn't recognize the request, error control isn't possible.

DATA COMPRESSION

If the modems successfully establish a V.42 connection, they also negotiate for V.42 *bis* data compression. If they successfully establish an MNP connection, they negotiate for MNP5 data compression.

Modems using V.42 *bis* compression negotiate the following options.

- Dictionary size—that is, the amount of memory available for compression table entries. (Entries are codes devised for redundant data. The data is packed into shorter data units, called code words, and unpacked by the receiving modem.)

  Possible sizes are as follows. USRobotics modems use 11-bit, or 2048-entry dictionaries, but drop down if the remote modem uses a 512- or 1024-entry dictionary.

Bits	Entries
9	512
10	1024
11	2048

- Maximum string length of each entry.

As the dictionary fills, the modem deletes the oldest unused strings. V.42 *bis* compression is more efficient than MNP5 compression in part because it dynamically deletes unusable strings. In addition, it works better with files that are already compressed. These include already compressed files, such as the .ZIP files downloaded from many Bulletin Boards, and 8-bit binary files, which appear to the modem to be compressed.

MNP5 compression should not be used with such files because it adds data to them, which lessens throughput. (The additional data is stripped when the file is decompressed by the remote modem.) When transferring such files, it's best to set the modem to &K3. This allows V.42 *bis* compression to work dynamically with the compressed data, but disables MNP5.

FLOW CONTROL

Flow control of data from the computer is required under error control for two reasons.

1. The transmitting modem buffers a copy of each frame it transmits to the remote end until it is acknowledged by the receiving modem.
2. If errors are encountered, the transmitting modem must resend the corrupted data. This retransmission activity, combined with the steady stream of data from the computer, can overflow the buffer.

THROUGHPUT GUIDELINES

The following guidelines should help you to make the most of your modem's advanced performance features. In many instances, experimentation and experience will indicate what works best for your applications.

Throughput is the volume of user information transferred per second, without Start and Stop bits and other overhead information. You'll obtain optimal throughput under the following conditions.

1. Your communications software supports a fixed serial port rate higher than the connection rate (for example, setting your software to lock into the 38.4K bps rate, and retaining the default &B1 setting).
2. The call is under data compression. See *Data Compression* (&K*n*) in this chapter.
3. You're transmitting text files. Throughput is higher for text files than other types of files, such as .EXE or .COM binary files.
4. File transfer may be slowed down by a file-transfer protocol. Many non-text files require a file-transfer protocol, but throughput results vary. Certain public domain file-transfer protocols, for example, have the following effects.

   Kermit — With the basic Kermit, throughput is severely reduced due to short block lengths (under 128 bytes) and acknowledgment turnaround time. Later enhancements to Kermit permit larger data block lengths with positive results.

   Xmodem — Throughput may be reduced if your version uses short block lengths, for example 128 bytes. Some versions use blocks of 1 kbyte, which is much better, although overhead (error-control protocol information) still affects overall throughput.

   Ymodem — This protocol is similar to Xmodem with 1-kbyte block lengths, and allows multiple files to be sent in one transfer.

   The above protocols further reduce throughput during error-control (ARQ) connections. The accuracy of the data is checked twice, by the file-transfer protocol and the modem. To avoid redundancy, disable modem error control by setting the modem to &M0.

   The most current version of **Zmodem** can yield the most efficiency. Leave the modem at its error-control default (&M4) and data compression default, &K3. Zmodem per-

forms the same kind of compression as V.42 *bis*; it turns off its compression if files are already compressed.

An alternative protocol is **Ymodem-G**, with the modem left at its error-control default, &M4. Ymodem-G assumes the modems are handling error control. Overhead is minimal, with throughput almost equal to that obtained with no file-transfer protocol. However, keep in mind that Ymodem-G is only useful if the modems are using error control. In addition, follow this recommendation only if your machine and software support hardware flow control.

NOTE: Both modems must use the same protocol for data transfer to take place.

WARNING: If you are using an X-, Y- or Zmodem-type protocol, *do not use the modem's software flow control.* See the more detailed warning in Chapter 4 under *Warning on Software Flow Control.*

ONLINE FALLBACK/FALL FORWARD

Under error control, if a disturbance on the phone line causes an error to a data block, the receiving modem replies with a negative acknowledgment. In response, the transmitting modem retrieves a copy of the original data block from its Transmit buffer, and every block it sent after that block, and retransmits them. This keeps the data error-free and in sequence.

However, there is a retransmit limit: the modems hang up if line disturbances are so severe that one of the modems has retransmitted the same block of data twelve times without a positive acknowledgment.

Because high-rate calls are more vulnerable than transmissions at 2400 bps and below, V.32 *bis* modems risk reaching the retransmit limit and hanging up. To prevent this, one of the modems requests that they fall back—that is they reduce their rate from 14.4K to 12K bps, and then to 9600 bps or lower, if necessary. When online conditions improve, the modems fall forward to the next higher rate, up to the link rate of the call.

Online fallback/fall forward is defined in ITU-T recommendation V.32 *bis* for modems with top phone-line rates of 14.4K bps. The Sportster 9600, however, is a V.32 modem. V.32 modems fallback to 4800 bps and stay at that rate.

ACHIEVABLE THROUGHPUT STATISTICS

The table below indicates the maximum throughput, in characters per second (cps), that can be expected under the following optimal conditions.

- Serial port rate set at 57.6K bps; modem set to &B1

  (Note that both your software and your computer must support 57.6K bps in order for you to use that rate.)
- Connection (link) rate of 14.4K bps (assuming no protective fallback to a lower speed is necessary)
- V.42 *bis* compression negotiated for the call, and the default size 11-bit, 2048-entry dictionary
- Straight data (that is, not already compressed, and no file-transfer protocol)
- Transmission from a fast (for example, 386) computer

	Throughput (cps) when set to 14.4K bps	
File Type	**MNP5**	**V.42 *bis***
Assembler or Compiler listing	2880	3840
Text file	2325-2625	3400-5760
Binary file: .EXE	2175-2400	2030-2600
Binary file: .COM	2100-2250	2050-2300
.ZIP files (common on BBS's)*	1500-1650	1700
Random binary 8-bit*	1460-1575	1700

* These files are already compressed or appear to the modem to be compressed. Additional MNP5 compression causes throughput lower than what can be expected using MNP without compression. We recommend setting the modem to &K3 when transferring these files, to allow V.42 *bis* but disable MNP5.

The following table indicates the maximum throughput, in characters per second (cps), that can normally be expected in the same conditions as the previous table, but with a serial port rate of 38.4K bps.

	Throughput (cps) when set to 14.4K bps	
File Type	**MNP5**	**V.42 *bis***
Assembler or Compiler listing	2880	3840
Text file	2325-2625	3400-3480
Binary file: .EXE	2175-2400	2030-2600
Binary file: .COM	2100-2250	2050-2300
.ZIP files (common on BBS's)*	1500-1650	1700
Random binary 8-bit*	1460-1575	1700

*We recommend setting the modem to &K3 when transferring these types of files. See the note attached to the previous table.

APPENDIX B. SUMMARIES AND TABLES

FRONT PANEL INDICATORS

Table B.1—LED Indicators

Symbol	Meaning	Status
AA	Auto Answer/ Answer	Answer mode only: ON if DIP switch 5 is UP (OFF) when the modem is powered on, or register S0 is set to 1 (Auto Answer mode), and when answering a call; OFF when the modem originates a call.
CD	Carrier Detect	ON if DIP switch 6 is UP (factory setting) and the modem receives a valid data signal (carrier) from a remote modem, indicating that data transmission is possible. Always ON if the CD override is ON (DIP switch 6 DOWN).
RD	Received Data	Flashes when the modem sends result codes or passes received data bits to the computer.
SD	Send Data	Flashes when the computer sends a data bit to the modem.
TR	Data Terminal Ready	ON if DIP switch 1 is UP (factory setting) and the modem receives a DTR signal from the computer. Always ON (modem ignores DTR) if the DTR override is on, DIP switch 1 DOWN.
CS	Clear to Send	ON until the modem lowers CTS when Transmit Data hardware flow control is enabled (&H1, &H3).
ARQ/ FAX	Error Control/ Fax Operations	Data Mode: Automatic Repeat Request. ON when the modem is set to &M4 or &M5 and successfully connects with another modem under error control. Flashes randomly when the modem retransmits data to the remote modem. Fax Mode: Flashes steadily to indicate fax mode.

THE RS-232 INTERFACE

Description

The RS-232 interface is a standard developed by the Electronic Industries Association (EIA). It defines the signals and voltages used when data is exchanged between a computer and a modem or serial printer.

The entire standard covers many more functions than are used in most data communications applications. Data is transmitted between the devices over an RS-232 cable with a 25-pin male (DB-25P) connector to the modem and a 25-pin, 9-pin, 8-pin or custom-built connector to the computer.

Pin Assignments

Pin assignments are factory-set in the Sportster modem to match the standard DB-25 assignments in the following table. DB-9 connectors for IBM PC/AT-compatible computers should be wired at the computer end of the cable as shown in the DB-9 column.

Table B.2—RS-232 Interface Pin Definitions

DB-25	DB-9	Circuit	Function	Signal Source Computer — Modem
1	–	AA	Chassis Ground	Both
2	3	BA	Transmitted Data	Computer
3	2	BB	Received Data	Modem
4	7	CA	Request to Send	Computer
5	8	CB	Clear to Send	Modem
6	6	CC	Data Set Ready	Modem
7	5	AB	Signal Ground	Both
8	1	CF	Carrier Detect	Modem
12	–	SCF	Speed Indicate	Modem
20	4	CD	Data Terminal Ready	Computer
22	9	CE	Ring Indicate	Modem

If you're using an Apple computer, ask your dealer for the correct modem cable for your Apple model; we recommend a Hardware Handshaking cable.

Table B.3—Macintosh 8-Pin DIN

DB-25	MAC	Function	Signal Source Computer — Modem
20/5[1]	1	Output Handshake[1]	Computer/Modem[1]
4	2[2]	Input Handshake	Computer
2	3[2]	Transmit Data -[3]	Computer
7	4	Ground	Both
3	5	Receive Data -[4]	Modem
–	6	Transmit Data +	–
–	7	Not connected	–
–	8	Receive Data +	–

[1] Adds CTS capability when in Hardware mode.
[2] Hardware handshaking lines.
[3] To do this, you must ground pin 6.
[4] To do this, you must ground pin 8.

NOTE: A three-wire interface consists of Receive, Transmit, and Ground wires and does not support hardware flow control. Systems requiring 3-wire interfaces must use software flow control.

Minimum Requirements

Some computer equipment supports only a few of the RS-232 signal functions set in the Sportster modem. The minimum required for the modem to operate is as follows.

Table B.4—Minimum Required Pins

DB-25 Pin	DB-9 Pin	8-Pin DIN	Function
2	3	3	Transmitted Data
3	2	5	Received Data
7	5	4	Signal Ground
20	4	1	Data Terminal Ready*

* Required if DIP switch 1 is UP (OFF).

Additional Flow Control Functions

If your computer and software support Clear to Send and you wish to use Transmit Data hardware flow control (&H1), Pin 5 (DB-25) or Pin 8 (DB-9) is required.

If your computer and software support Request to Send and you wish to use Received Data hardware flow control (&R2), Pin 4 (DB-25) or Pin 7 (DB-9) is required.

For 57.6K and 38.4K bps Serial Port Rate

Your software and computer must support the 57.6K or 38.4K bps rate. Make sure the RS-232 cable is shielded. Cables are normally six feet long, but longer lengths are possible. If you encounter problems with signal degradation, try a shorter cable.

If you decide to build your own cable, use a low-capacitance cable. To further minimize the capacitance, connect only those functions (pins) that your application requires.

DIP SWITCH SUMMARY

Purpose

The DIP switches, located at the rear of the modem, are for adapting the modem to your equipment and personal requirements. The *STOP* guide that came with the Sportster modem indicates the recommended switch settings for many communications software packages. If your software isn't included, you may need to review your software documentation to set DIP switches 1 and 6 correctly for your program's requirements.

Some users are able to move a single switch with a finger tip. If this doesn't work for you, use a toothpick or other small instrument.

Operations

The DIP switch settings are power-on and reset defaults, read by the Sportster when the computer is turned on or when you reset

the modem. If changed when the modem is on, switches 1–7 require the ATZ (reset) command to initiate the new settings. DIP switch 8 is automatically operative when set UP or DOWN.

Table B.5—DIP Switches

Switch	Factory Setting	Function
1	UP	Data Terminal Ready (DTR) Operations UP Normal DTR operations: computer or terminal must provide DTR signal for modem to accept commands; dropping DTR terminates a call DOWN Modem ignores DTR (Override)
2	UP	Verbal/Numeric Result Codes UP Verbal (word) results DOWN Numeric results
3	DOWN	Result Code Display UP Results suppressed DOWN Results enabled
4	UP	Command Mode Local Echo UP Keyboard commands displayed DOWN Echo suppressed
5	DOWN	Auto Answer UP Modem answers on first ring DOWN Auto answer disabled
6	UP	Carrier Detect (CD) Operations UP Modem sends CD signal when it connects with another modem, drops CD on disconnect DOWN CD always ON (Override)
7	UP	Power-on and ATZ Reset Software Defaults UP Load Y or Y1 configuration from user-defined nonvolatile memory (NVRAM) DOWN Load &F0—Generic template from read only memory (ROM)
8	DOWN	AT Command Set Recognition UP Command recognition disabled (Dumb Mode) DOWN Recognition enabled (Smart mode)

DEFAULT SETTINGS

User-Customizable Defaults

You can create one or two customized configurations and store one of them at a time in nonvolatile random access memory (NVRAM) as your power-on/reset default using the &W command described in Chapter 4. As long as DIP switch 7 is UP when you power on or reset the modem, your defaults are loaded into the modem's random access memory (RAM). To view your NVRAM settings, use the ATI5 command.

The Sportster modem is preconfigured in the factory for the &F1—Hardware Flow Control template in NVRAM as Y0, and the &F2—Software Flow Control template in NVRAM as Y1.

If you are using hardware flow control, copy the Y0 template (&F1—Hardware Flow Control) to NVRAM Y1, as well.

AT &F1 &W1 >Enter>

If you cannot use hardware flow control, copy the Y1 template (&F2—Software Flow Control) to NVRAM Y0, as well.

AT &F2 &W <Enter>

If you cannot use hardware flow control and need to use Xmodem-type file transfer protocols, use either Y0 or Y1 for a no flow control configuration with no error control.

AT &F0 &M &W <Enter>

or

AT &F0 &M &W1 <Enter>

Tables on the next pages list the settings of the permanent configuration templates &F0, &F1, and &F2, as well as the other settings you can modify and store in the NVRAM configuration templates. Table B.8 lists the S-Registers that may be modified, and are the same in all &F templates.

Table B.6—&F1—Hardware Flow Control Template

Feature	&F1	Default
ITU-T/Bell Answer Sequence	B0	ITU-T sequence
Online/Duplex Echo	F1	OnlineEcho OFF
Speaker Control	M1	Speaker ON until CONNECT
Pulse/Tone Dialing	P	Pulse Dialing
Result Code Options	X4	All Result codes
ARQ Result Codes	&A3	All protocol codes enabled
Serial Port Rate	&B1	Fixed serial port rate
Guard Tone	&G0	No guard tone
Transmit Data Flow Control	&H1	Hardware flow control
Modem Testing	&T5	Deny remote digital loopback
Received Data Hardware Flow Control	&R2	Enabled
Received Data Software Flow Control	&I0	Disabled
Data Compression	&K3	Auto enable/disable
Error Control	&M4	Auto select
Connection Rate	&N0	Variable connection rate
Make/Break Ratio	&P0	U.S./Canada ratio
Data Set Ready (DSR)	&S0	DSR always on
Break Handling	&Y1	Break clears buffer; break then goes to remote modem
Stored Phone Numbers	&Z*n=s*	
Word Length	8 bits*	
Parity	None*	
Serial Port Rate	19.2 kbps*	

* Initial Settings; match software settings of subsequent &W commands.

The &F2 and &F0 templates largely resembe the &F1 template. The tables below list only those settings that differ from the &F1 template.

Table B.6A—&F2—Software Flow Control Template

Feature	&F1 Default	&F2	Default
Transmit Data Flow Control	&H1	&H2	Transmit data software flow control
Receive Data Flow Control	&R2	&R0	Received data hardware flow control
	&I0	&I2	Received data software flow control

Table B.6B—&F0—Generic Template

Feature	&F1 Default	&F0	Default
Result Code Options	X4	X1	Extended subset
ARQ Result Codes	&A3	&A1	ARQ codes enabled
Serial Port Rate	&B1	&B0	Variable serial port rate
Transmit Data Flow Control	&H1	&H0	Disabled
Receive Data Flow Control	&R2	&R1	Disabled
Word Length	8 bits	7 bits*	
Parity	None	Even*	
Serial Port Rate	19.2 kbps	9600 bps*	

* Initial Settings; match software settings of subsequent &W commands.

Table B.7—NVRAM S-Register Options

NVRAM S-Register Options		Factory Setting
S0	Number of rings to answer on	1
S2	Escape code character	43
S3	Carriage Return character	13
S4	Line Feed character	10
S5	Backspace character	8
S6	Dial wait-time, sec.	2
S7	Carrier wait-time, sec.	60
S8	Dial pause, sec.	2
S9	Carrier Detect time, 1/10th sec.	6
S10	Carrier loss wait-time, 1/10th sec.	7
S11	Tone duration, spacing, msec.	70
S12	Escape code guard time, 1/50th sec.	50
S13	Bit-mapped functions	0
S14	Bit-mapped functions	0
S15	Bit-mapped functions	0
S19	Inactivity/hang up timer	0
S21	Break length, 1/100th msec.	10
S22	XON character	17
S23	XOFF character	19
S25	DTR recognition time, 1/100th sec.	5
S27	Bit-mapped functions	0
S28	V.21/V.23 fallback delay, 1/10th msec.	8
S34	Bit-mapped functions	6
S38	Disconnect wait time, sec.	0

NOTE: Bit-mapped registers have up to eight functions. See instructions under *S13* in the *S-Register Summary*, next in this appendix, or the briefer summary in the Quick Reference Card.

S-REGISTER SUMMARY

Table B.8—S-Registers

Register	Default	Function
S0	See DIP Switch 5	Sets the number of rings on which to answer in Auto Answer Mode. When DIP switch 5 is UP the modem answers on the first ring; S0=1 does the same. When DIP switch 5 is DOWN (factory setting), Auto Answer is disabled; S0=0 (modem answers on 0 rings, or never) does the same.
S1	0	Counts and stores the number of rings from an incoming call.
S2	43	Stores the ASCII decimal code for the escape code character. Default character is "+." A value of 128–255 disables the escape code.
S3	13	Stores the ASCII code for the Carriage Return character. Valid range is 0–127.
S4	10	Stores the ASCII decimal code for the Line Feed character. Valid range is 0–127.
S5	8	Stores the ASCII decimal code for the Backspace character. A value of 128–255 disables the Backspace key's delete function.
S6	2	Sets the number of seconds the modem waits before dialing. If set to X2 or X4, the modem ignores this register and dials as soon as it detects a dial tone (fast dials).

Register	Default	Function
S7	60	Sets the number of seconds the modem waits for a carrier. May be set for much longer duration if, for example, the modem is originating an international connection.
S8	2	Sets the duration, in seconds, for the pause (,) option in the Dial command.
S9	6	Sets the required duration, in tenths of a second, of the remote modem's carrier signal before recognition by the Sportster.
S10	7	Sets the duration, in tenths of a second, that the modem waits after loss of carrier before hanging up. This guard time allows the modem to distinguish between a line hit, or other disturbances that momentarily break the connection, from a true disconnect (hang up) by the remote modem. While we don't recommend connecting the modem to a line with call waiting, if you have it, you may wish to adjust this setting upward to prevent the modem from misinterpreting the second call signal as a disconnect by the remote modem. A better alternative is to ask your phone company how to temporarily disable call waiting. **NOTE:** If you set S10=255, the modem will not hang up when carrier is lost. Dropping DTR will force the modem to hang up.
S11	70	Sets the duration and spacing, in milliseconds, for tone dialing.

Register	Default	Function
S12	50	Sets the duration, in fiftieths of a second, of the guard time for the escape code sequence (+++).
S13	0	Bit-mapped register. Select the bit(s) you want on and set S13 to the total of the values in the Value column. For example, ATS13=17 enables bit 0 (value is 1) and bit 4 (value is 16).

Bit	Value	Result
0	1	Reset when DTR drops.
1	2	Reserved.
2	4	Reserved.
3	8	On DTR signal, Auto Dial the number stored in NVRAM at position 0.
4	16	At power on/reset, Auto Dial number stored in NVRAM at position 0.
5	32	Reserved.
6	64	Disable MNP Level 3 (used for testing Level 2).
7	128	Reserved.

Register	Default	Function
S14	0	Bit-mapped. Allowable non-default value is 1.

Bit	Value	Result
0	1	The modem hangs up on receipt of +++, returns to command mode and sends the NO CARRIER result code; see *Escape Code Operations* in Chapter 3.
1–7	–	Reserved.

Register	Default	Function
S15	0	Bit-mapped register. To set the register, see the instructions for S13.

Bit	Value	Result
0–2	–	Reserved.
3	8	Reset non-ARQ mode Transmit buffer from 1.5K bytes to 128.*
4	16	Disable MNP Level 4; retransmitting the larger Level 4 data blocks may be a problem if you expect a great number of errors during a call.
5	32	Set backspace key to delete.
6–7	–	Reserved.

*The 1.5K-byte non-ARQ buffer allows data transfer with X- and Ymodem-type file transfer protocols without using flow control.

The 128-byte option lets remote users with slower modems stop data you're sending from scrolling off their screens. When remote users send your computer an XOFF (Ctrl-S) and you stop transmitting, the data in transit from your modem's buffer doesn't exceed the size of their screen.

S16	0	Bit-mapped test register. Allowable value is 2. For information on the Dial test (used in factory testing), see Appendix D.

Bit	Value	Result
0	–	Reserved.
1	2	Dial test.
2–7	–	Reserved.

S17	0	Reserved.

Register	Default	Function
S18	0	Test timer for &T*n* loopback testing. Sets the time in seconds of testing before the modem automatically times out and terminates the test. When set to 0, the timer is disabled. See Appendix D for instructions.
S19	0	Sets the duration, in minutes, for the Inactivity Timer. The timer activates when there is no data activity on the phone line; at timeout the modem hangs up. S19=0 disables the timer.
S20	0	Reserved.
S21	10	Sets the length, in 10-millisecond units, of Breaks sent from the modem to the computer or terminal; applies to ARQ mode only.
S22	17	Stores the ASCII decimal code for the XON character. Valid range is 0–127.
S23	19	Stores the ASCII decimal code for the XOFF character. Valid range is 0–127.
S24	0	Reserved.
S25	5	Sets the duration, in hundredths of a second, that DTR must be dropped so that the modem doesn't interpret a random glitch as a DTR loss. (Most users will want to use the default; this register is useful for setting compatibility with older systems running under older operating software.)
S26	0	Reserved.

Register	Default	Function
S27	0	Bit-mapped register. To set the register, see the instructions for S13.

Bit	Value	Result
0	1	Enable ITU-T V.21 modulation at 300 bps for overseas calls; in V.21 mode, the modem answers both overseas and domestic (U.S. and Canada) calls, but only originates V.21 calls.
1	2	Enable unencoded (non-trellis-coded) modulation in V.32 mode; rarely used part of ITU-T Recommendation V.32.
2	4	Disable V.32 modulation.
3	8	Disable 2100 Hz answer tone to allow two V.42 modems to connect more quickly.
4	16	See below.
5	32	See below.
6	64	Reserved.
7	128	Unusual software incompatibility. Some software may not accept 7200, 12,000 and 14,400 bps result codes. This setting disables the codes and displays the 9600 code instead. The call's actual rate can be viewed on the ATI6 screen.

Error control handshaking options: select the total values of bits 4 and 5.

Register	Default	Function		
		Bit 4	**Bit 5**	**Result**
		0	0	Complete handshaking sequence: V.42 Detection, LAPM error control, MNP.
		16	0	Disable MNP.
		0	32	Disable V.42 Detection and LAPM.
		16	32	Combined value of 48 negotiates LAPM without Detection phase. Choose this value if the remote modem uses LAPM but does not support the Detection phase.
S28	8	Sets the duration, in tenths of a second, of the EIA-specified Multimode Training. Default = 8 (.8 seconds). This gives V.32 *bis* modems additional time to connect with most U.S./Canada modems at 9600 bps or higher before falling back to attempt a V.23 connection (some U.K. and European phone systems, 1200 bps) or a V.21 connection (U.K. and Europe, 300 bps). If calling/answering low-speed, overseas modems under V.21 or V.23 modulation, setting S28 to zero eliminates the delay, giving a faster connect time.		
S29	20	Reserved for USRobotics' internal use.		
S30	0	Reserved.		
S31	0	Reserved.		
S32	1	Reserved.		
S33	0	Reserved.		

Register	Default	Function
S34	6	Bit mapped. Allowable values are S34=6, S34=7, S34=14, and S34=15.

Bit	Value	Result
0	1	Disable V.32 *bis*. Used for troubleshooting; USRobotics' Technical Support may require that you disable V.32 *bis* for testing purposes.
1–2	–	Reserved.
3	8	Enable V.23 modulation
4–7	–	Reserved.

S35	0	Reserved.
S36	0	Reserved.
S37	0	Reserved.
S38	0	Sets an optional delay, in seconds, before a forced hang-up and clearing of the Transmit buffer when DTR drops during an ARQ call. This allows time for a remote modem to acknowledge receipt of all transmitted data before it is disconnected. Default = 0: the modem immediately hangs up when DTR drops. This option only applies to connections terminated by dropping DTR. If the modem receives the ATH command, it ignores S38 and immediately hangs up.

ASCII CHART

The following chart may be useful for programming.

ASCII CHART

DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR	DEC	HEX	CHAR
00	00	NUL	32	20	SP	64	40	@	96	60	`
01	01	SOH	33	21	!	65	41	A	97	61	a
02	02	STX	34	22	"	66	42	B	98	62	b
03	03	ETX	35	23	#	67	43	C	99	63	c
04	04	EOT	36	24	$	68	44	D	100	64	d
05	05	ENQ	37	25	%	69	45	E	101	65	e
06	06	ACK	38	26	&	70	46	F	102	66	f
07	07	BEL	39	27	'	71	47	G	103	67	g
08	08	BS	40	28	(	72	48	H	104	68	h
09	09	HT	41	29	)	73	49	I	105	69	i
10	0A	LF	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	45	2D	-	77	4D	M	109	6D	m
14	0E	SO	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	48	30	0	80	50	P	112	70	p
17	11	XON	49	31	1	81	51	Q	113	71	q
18	12	DC2	50	32	2	82	52	R	114	72	r
19	13	XOFF	51	33	3	83	53	S	115	73	s
20	14	DC4	52	34	4	84	54	T	116	74	t
21	15	NAK	53	35	5	85	55	U	117	75	u
22	16	SYN	54	36	6	86	56	V	118	76	v
23	17	ETB	55	37	7	87	57	W	119	77	w
24	18	CAN	56	38	8	88	58	X	120	78	x
25	19	EM	57	39	9	89	59	Y	121	79	y
26	1A	SUB	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	62	3E	>	94	5E	^	126	7E	~
31	1F	US	63	3F	?	95	5F	_	127	7F	DEL

APPENDIX C. FAX AND OTHER OPERATIONS

FAX OPERATIONS

Fax Modem Guidelines

Fax operations require facsimile-compatible software that can send or receive Group III faxes. Follow the instructions in your fax software manual.

The modem's normal operating mode is Data mode. If your fax software is typical, it automatically switches the modem to Fax mode when you run the program, and resets the modem to Data mode when you exit the program.

If you have a problem, however, and think the modem may be in the wrong mode, you can use one of the following AT commands to manually switch the modem:

AT+FCLASS=0 (Switch to Data mode)
AT+FCLASS=1 (Switch to Fax mode)

If you are not sure whether the modem is in Data or Fax mode, type the following command.

AT+FCLASS?

The modem returns a 0 to indicate Data mode or a 1 to indicate Fax mode.

NOTE: Whenever the fax modem is reset using the ATZ command, toggling the DTR signal, or turning the power off and on, the modem will be set to Data mode.

Fax Mode Flow Control Setting

Many facsimile software products use software flow control when the modem is in Fax mode. To allow compatibility with software products that use software flow control by default, USRobotics fax modems switch to software flow control when entering Fax mode.

For the best information on modem settings, see your Fax software manual.

FCC Notice

FCC part 68, rules regarding fax operation, has been amended as follows:

> Telephone facsimile machines—identification of the sender of the message: It shall be unlawful for any person within the United States to use a computer or other electronic device to send any message via a telephone facsimile machine unless such a message clearly contains, in a margin at the top or bottom of each transmitted page or on the first page of the transmission, the date and time it is sent and an identification of the business, other entity, or individual sending the message and the telephone number of the sending machine or of such business, other entity, or individual. Telephone facsimile machines manufactured on and after December 20, 1992 must clearly mark such indentifying information on each transmitted page.

A Note to Programmers

If you want to know more about the supported fax commands, refer to the standard for the Service Class 1 fax protocol.

> ANSI/EIA/TIA-578-1990 (EIA-578)
> Asynchronous Facsimile DCE Control Standard
> November, 1990 Approved: October 22, 1990

You can obtain a copy of this standard by contacting Global Engineering Documents, at 1-800-854-7179.

HIGH SPEED/LOW SPEED PROTOCOL

Overview

This section explains how an answering Sportster modem switches its connection rate to match the rate of a calling modem. It may be of help to those who want to try programming their computers to switch rates to match the Sportster modem's connection rate. The material here applies only when the modem is set for variable rates at both the serial port and connection interfaces, &B0 and &N0, respectively.

In both Originate and Answer modes, if the connection rate is set to &N0, the Sportster negotiates with the remote modem to connect at the highest possible rate. In addition, if the modem is set to Extended or Advanced result codes (X1 or higher) it signals the computer with one of the following result codes or the optional protocol result codes selected with the &A*n* command.

CONNECT	(300 bps)
CONNECT 1200	(1200 bps)
CONNECT 2400	(2400 bps)
CONNECT 4800	(4800 bps)
CONNECT 7200	(7200 bps)
CONNECT 9600	(9600 bps)
CONNECT 12000	(12,000 bps)
CONNECT 14400	(14,400 bps)

NOTE: 14.4K and 12K refer to modems with V.32 *bis* only.

The modem sends the result code at its previous rate. Then it switches to the new connection rate.

If your software doesn't switch rates and you want to program it to do so, use the example on the next page as a guide. It demonstrates the occurrence of the CONNECT codes in the connection sequence, so that recognition of the codes can be used to switch the software. The example uses a sequence of incoming calls, but the codes also apply to Originate mode connections as long as the modem dials out at a rate higher than or equal to the remote modem's rate.

The example below assumes the following settings.

Software: Initially 19.2K bps or higher, allowing the following range of connection rates:
14.4K/12K/9600/7200/4800/2400/1200/300 bps

NOTE: 14.4K and 12K refer to modems with V.32 *bis* only.

Modem: X1 or higher (rate-specific CONNECT codes), &B0 (variable serial port rate), &N0 (variable connection rate)

Example

Action	Modem Response	Serial Port Rate
1. Power on.		19,200
2. 300-bps call comes in.	RING CONNECT	19,200 19,200
3. Data link is established. Data transfer takes place.		300
4. Data session is over. Call is ended; loss of carrier.	NO CARRIER	300
5. 2400-bps call comes in.	RING CONNECT 2400	300 300
6. Data link is established. Data transfer takes place.		2400
7. Data session is over. Call is ended; loss of carrier.	NO CARRIER	2400
8. 14.4K-bps call comes in.	RING CONNECT 14400	2400 2400
9. Data link is established. Data transfer takes place.		19,200
10. Data session is over. Call is ended; loss of carrier.	NO CARRIER	19,200

Explanation

1. The modem is powered on and is operating at 19.2K bps or higher, so that it is able to connect at 14.4K bps as well as at lower rates.
2. A 300-bps modem calls. The Sportster senses the incoming signal and sends the messages RING and CONNECT to the computer. These messages are sent at 19.2K bps, the current serial port rate.
3. Since the Sportster responds CONNECT, rather than with a rate indicator, the software switches to 300 bps. The modem automatically shifts to 300 bps to accept the data from the incoming call.
4. The 300-bps data session is terminated; the modem sends the computer the message NO CARRIER at 300 bps.
5. A 2400-bps call comes in. The modem responds RING and CONNECT 2400. These message are sent at the current bit rate of 300 bps.
6. The software, receiving the CONNECT 2400 message, adjusts accordingly to the higher bit rate. The modem also shifts to 2400 bps.
7. The 2400-bps data session is terminated; the modem sends the computer the message NO CARRIER at 2400 bps.
8. A 14,400-bps call comes in. The modem responds RING and CONNECT 14400. These messages are sent to the computer at the current bit rate of 2400 bps.
9. The software, detecting the CONNECT 14400 message, adjusts accordingly to the higher bit rate. The modem also shifts to 14,400 bps.
10. The 14,400-bps data session is terminated; the modem sends the message NO CARRIER at 14,400 bps.

Keep in mind that whether or not your computer adjusts to these rate changes, the Sportster automatically shifts connection rates if it is set to &N0.

VOICE/DATA COMMUNICATIONS

When you install the Sportster, you have the option of plugging your phone into the second modular jack of the modem so it's available for voice calls. You can also use the phone to set up communications with another user whose modem uses the AT command set, such as a USRobotics or USRobotics-compatible modem.

Preparation

First call the other user to establish the parity, word length and number of Stop bits the other person's modem accepts. Then turn the call over to your modems, as follows.

Procedures

1. Without hanging up the phone, have your modem go off hook in Originate mode. Type the following command.

   ATD <Enter>

   NOTE: Be sure the modem is *not* set to X2 or X4, or it will return the NO DIAL TONE result code and hang up.

2. The other party should have the remote modem go off hook in Answer mode. The following command is used to do this.

   ATA <Enter>

3. Now both of you can hang up your respective phones while the two modems establish the data link. They will maintain the link until one of you gives your modem a command to disconnect.

   Either party's device can be the originate or answer modem; it doesn't matter who made the phone call. But one modem must enter Originate mode and the other then enter Answer mode. You and the other party, therefore, must agree on which command, ATD or ATA, you will each use.

APPENDIX D. MODEM TESTING

Modem testing is available with the &T command and Register S16 (Dial test). All loopback testing conforms to ITU-T Recommendation V.54.

NOTE: Only one test can be performed at a given time. If you send a test command while the modem is in test mode, you'll receive an ERROR message.

TESTING WITH &T

The tests supported through the &T command include analog loopback, digital loopback, and remote digital loopback. You can key in your own data during testing, or use the modem's internal test pattern and error detector.

In all cases, disable error control before testing. If the modem is detecting errors and retransmitting the affected data, your test results will be invalid.

Ending a Test—&T0, S18

Issuing the &T0 command terminates a test. Alternatively, set Register S18 to a specified number of seconds, for example, S18=10. When the 10 seconds are up, the modem automatically ends the test and returns to Command mode. If the test was Analog Loopback, the &T0 command hangs the modem up. If the test was Digital or Remote Digital Loopback, issue an ATH command to hang up the modem, or an ATZ command to hang up the modem and reset it to its defaults.

NOTE: If you use the S18 test timer, but in the process of testing you issue an ATZ command, S18 resets to zero and the timer is disabled. Also, you cannot store a value for S18 in nonvolatile memory; its power-on and reset default is always zero.

Analog Loopback—&T1, &T8

This test checks the operation of the modem's transmitter and receiver. Data flow is shown in Figure D.1. *Modem/DTE* indicates the modem's interface with the computer (Data Terminal Equipment).

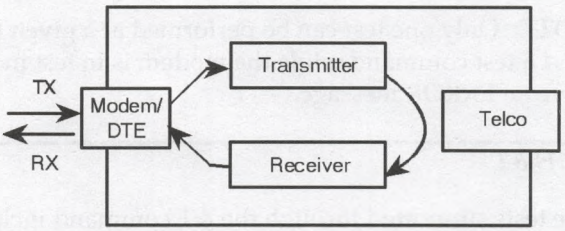

Figure D.1—Data Flow During Analog Loopback

There are two analog loopback options. The first, &T1, involves your typing data that you can verify at your screen.

The second option, &T8, is an internal self-test that does not involve the keyboard or screen. It isolates the modem from the computer interface to give you a more specific result.

&T1

1. The modem should be on hook in Command mode. If you wish, set Register S18 as a test timer. For example, insert S18=10 in the following command string before &T1.

   AT &M0 S18=10 &T1 <Enter>

   The modem disables error control, sets the timer, enters analog loopback (AL) mode, and sends a CONNECT message.

2. Type recognizable data so that you can verify it when it is looped back to the screen.

3. End the test. If you set S18, the modem automatically stops the test at the timeout, exits AL mode and responds OK.

If you didn't set Register S18, wait one second and type +++ to end the test and return the modem to Command mode. When the modem responds OK, type AT&T0 to terminate AL mode and hang up the modem. (Typing ATH has the same effect. Typing ATZ also has the same effect, but also resets the modem and restores your &M default.)

The modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.

4. If there were no errors, reset the modem to &M4, for error control, unless you've issued the ATZ reset command.

   NOTE: If the modem is in Online-command mode—that is, still connected to a remote modem—and you send it an &T1 or &T8 command, it drops the call, enters AL mode, sends a CONNECT result and waits for loopback characters.

&T8

This AL option causes the modem to send an internal test pattern to its transmitter and loop it back to the receiver. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

Since you don't type anything during this test, and the modem does not send anything to the screen, this option verifies only the modem. If there are no errors but your problem continues, it may be at the computer interface.

1. The modem should be on hook in Command mode. If you wish, set Register S18 as a test timer. For example, insert S18=10 in the following command string before &T8.

   AT &M0 S18=10 &T8 <Enter>

   The modem disables error control, sets the timer and enters AL mode. The modem sends its internal test pattern to the transmitter, and loops the pattern back to the receiver. You will not see any data on your screen.

2. End the test. If you set S18, the modem automatically stops the test at the timeout. If you didn't set Register S18, type AT&T0 to end the test. Or use ATH or the command that

resets the modem, ATZ. Both of the latter end the test and hang up the modem.

When the modem hangs up it returns a three-digit code, followed by OK. A code of 000 indicates no errors were found. A code of 255 indicates 255 or more errors. An ERROR message indicates that you issued an invalid command.

3. If there were no errors, reset the modem to &M4 for error control unless you issued the ATZ command.

&T2

This option is reserved.

Digital Loopback—&T3

If your modem has passed the AL test, this test can help you locate a problem with a remote modem or the telephone channel. Figure D.2 shows the data flow during Digital Loopback (DL) testing. *Modem/DTE* indicates the modem's interface with the computer (Data Terminal Equipment).

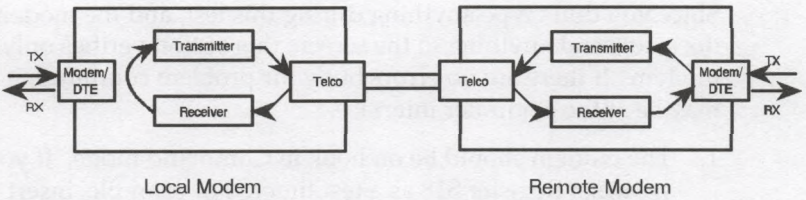

Figure D.2—Data Flow During Digital Loopback

1. Set the modem to &M0, to disable error control. Establish a connection with the remote modem.
2. Bring the modem back to Online-Command mode with the +++ escape code. Then send it the AT&T3 command. The modem enters DL mode.
3. The remote user should type a short message. It will be looped back by your modem's transmitter for verification on

the remote screen. You will not see the message or any other data.

4. When the remote user has completed the test, issue the AT&T0 command to end the test. If you wish, return the modem online (ATO) to resume data mode. Or type either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If the modem sends an ERROR message, you have issued an invalid command.

&T4, &T5

The &T4 option causes the modem to grant a remote modem's request for a Remote Digital Loopback test.

The &T5 option cancels &T4, and the modem fails to recognize such a request. This is the default so that your modem isn't subject to another user calling and tying up your modem without your permission.

Remote Digital Loopback—&T6, &T7

This test, like the local digital loopback test, verifies the condition of both modems and the phone link. Data flow is shown in Figure D.3. *Modem/DTE* indicates the modem's interface with the computer (Data Terminal Equipment).

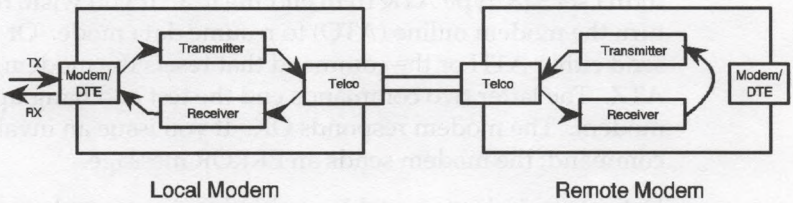

Figure D.3—Data Flow During Remote Digital Loopback

The request for and granting of Remote Digital Loopback testing requires that both modems use ITU-T V.54 standard signaling. *The test must be performed at 2400 or 1200 bps.* If the remote mo-

dem does not have the capability or is not set to respond, you will get an ERROR result code.

As with Analog Loopback, there are two Remote Digital Loopback options. If you select &T6, you send keyboard data to the modem and verify it when it is returned over the phone lines and to your screen. If you select &T7, the modem sends its internal test pattern and returns an error count to your screen.

&T6

1. Set your software to 2400 or 1200 bps. Set the modem to &M0. If you wish, set the S18 timer.

   Establish a connection with the remote modem. If you haven't already done so, arrange with the remote user to cooperate with your testing. The remote user should set his or her modem to acknowledge the RDL request, for example, AT&T4.

2. Bring the modem back to Online-Command mode with the +++ escape code. Send it the AT&T6 command. The modem enters RDL mode.

3. Type a short message. It will be looped back to your modem by the remote modem and to your screen for verification. (The remote user will not see your data.)

4. End the test. If you set Register S18 the modem automatically ends the test when the test timeout is reached. If you didn't set S18, type AT&T0 to end the test. If you wish, return the modem online (ATO) to resume data mode. Or send either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem. The modem responds OK. If you issue an invalid command, the modem sends an ERROR message.

   Data errors indicate a problem with the remote modem or the phone link. If you have not performed analog loopback testing with your modem, the problem may also lie with your modem.

5. Reset the modem to &M4 unless you used the reset command, ATZ.

&T7

This test option causes the modem to send an internal test pattern through the Remote Digital Loopback. An internal error detector counts any errors and, when the test is ended, sends the number of errors or 000 (no errors) to the screen.

You don't need to type anything during this test. The modem sends only its final error count to your screen.

1. Set your software to 2400 or 1200 bps. Set the modem to &M0. If you wish, set the S18 timer.

   Establish a connection with the remote modem. If you haven't already done so, arrange with the remote user to cooperate with your testing. The remote user should set his or her modem to acknowledge the RDL request, for example, AT&T4.

2. Bring the modem back to Online-command mode with the +++ escape code. Then send it the AT&T7 command. The modem enters RDL mode.

   The modem sends its internal test pattern to the remote modem, which loops it back to your modem. You will not see the data on your screen.

3. End the test. If you set S18, the modem automatically stops the test when the timer times out. If you didn't set Register S18, type AT&T0 to end the test. After you view the test results (next paragraph), return the modem online if you wish (ATO) and resume data mode. Or send either ATH or the command that resets the modem, ATZ. The latter two commands end the test and hang up the modem.

   When you terminate the test, the modem returns a three-digit code, followed by OK. A code of 000 indicates no errors were found. A code of 255 indicates 255 or more errors. If you issue an invalid command, the modem sends an ERROR message.

   If you've performed an Analog Loopback and know your modem is working properly, errors indicate a problem with either the phone connection or the remote modem.

4. Reset the modem to &M4 unless you've sent it the ATZ reset command.

DIAL TEST—S16=2

The Dial test is used for factory-testing the frequencies of tone dialing values. When S-Register 16 is set to 2 and a single tone is dialed (for example, ATD7 <Enter>), the modem continues to transmit that tone until you press the Enter key again.

APPENDIX E. GLOSSARY

Cross-references in the following definitions are printed in boldface.

Analog Loopback

A modem self-test in which data from the keyboard or an internal test pattern is sent to the modem's transmitter, modulated into **analog** form, looped back to the receiver, and demodulated into **digital** form.

Analog Signals

Continuous, varying waveforms such as the voice tones carried over phone lines. Contrast with **digital signals**.

Answer Mode

A state in which the modem transmits at the predefined high frequency of the communications channel and receives at the low frequency. The transmit/receive frequencies are the reverse of the calling modem, which is in **Originate mode**.

Application (application program)

A computer program designed to perform a specific function, such as a word processor or a spreadsheet.

ARQ

Automatic Repeat Request. A general term for **error control** protocols that feature error detection and automatic retransmission of corrupted blocks of data. See **MNP** and **V.42**.

ASCII

American Standard Code for Information Interchange. A 7-bit binary code (0's, 1's) used to represent letters, numbers, and special characters such as $, !, and /.

Asynchronous Transmission

Data transmission in which the length of time between transmitted **characters** may vary. Because the time lapses between transmitted characters are not uniform, the receiving modem

must be signaled as to when the data bits of a character begin and when they end. The addition of **Start** and **Stop bits** to each character serves this purpose.

Auto Answer

A feature in modems enabling them to answer incoming calls over the phone lines without the use of a telephone receiver.

Auto Dial

A feature in modems enabling them to dial phone numbers over the phone system without the use of a telephone transmitter.

Baud Rate

The number of discrete signal events per second occurring on a communications channel. Although not technically accurate for phone-line transmission, baud rate is commonly used to mean **bit rate**.

Binary Digit

A 0 or 1, reflecting the use of the binary numbering system (only two digits). Used because the computer recognizes either of two states, OFF or ON. Shortened form of binary digit is **bit**.

Bit Rate

The number of **binary digits**, or bits, transmitted per second (**bps**). Communications channels using telephone channel modems are established at set bit rates, commonly 300, 1200, 2400, 4800, 9600, and 14,400.

BPS

The bits (**binary digits**) per second rate. Thousands of bits per second are expressed as kilobits.

Buffer

A memory area used as temporary storage during input and output operations. An example is the modem's command buffer.

Byte

A group of **binary digits** stored and operated upon as a unit. A byte may have a coded value equal to a character in the **ASCII** code (letters, numbers), or have some other value meaningful to the computer. In user documentation, the term usually refers to 8-bit units or characters. 1 kilobyte (Kbyte) is equal to 1,024 bytes or characters; 640 Kbytes indicates 655,360 bytes or characters.

Carrier

A continuous frequency that can either be modulated or impressed with another information-carrying signal. Carriers are generated and maintained by modems via the transmission lines of the telephone companies.

CCITT

The International Telegraph and Telephone Consultative Committee. An international organization that defined standards for many of the V.x standards governing modem communications. These standards are now defined by the Telecommunications Sector of the International Telecommunication Union (**ITU-T**).

Character

A representation, coded in **binary digits**, of a letter, number, or other symbol.

Characters Per Second

A data transfer rate generally estimated from the **bit rate** and the **character** length. For example, at 2400 bps, 8-bit characters with **Start** and **Stop bits** (for a total of ten bits per character) will be transmitted at a rate of approximately 240 characters per second (cps). Some protocols, such as the Sportster's error-control protocols, employ advanced techniques such as longer transmission **frames** and **data compression** to increase cps.

Class 1/EIA-578

An American standard used between facsimile application programs and facsimile modems for sending and receiving faxes.

Cyclic Redundancy Checking (CRC)

An error-detection technique consisting of a cyclic algorithm performed on each block or **frame** of data by both sending and receiving modems. The sending modem inserts the results of its computation in each data block in the form of a CRC code. The receiving modem compares its results with the received CRC code and responds with either a positive or negative acknowledgment. In the **ARQ** protocols implemented in the Sportster, the receiving modem accepts no more data until a defective block is received correctly.

Data Communications

A type of communications in which computers and terminals are able to exchange data over an electronic medium.

Data Compression

A protocol that defines encoding of redundant data into smaller units before transmission over the phone line. The receiving modem decompresses the redundant data units before passing them to the receiving computer.

Data Compression Table

A table of values assigned for each character during a call under MNP5 data compression. Default values in the table are continually altered and built during each call: the longer the table, the more efficient **throughput** gained.

Data Mode

The mode in which the fax modem is capable of sending and receiving data files. A standard modem without fax capabilites is always in data mode.

DCE

Data Communication (or Circuit-Terminating) Equipment, such as dial-up modems that establish and control the data link via the telephone network.

Default

Any setting assumed, at startup or reset, by the computer's software and attached devices, and operational until changed by the user.

Detect Phase

In the ITU-T V.42 error-control protocol, the first stage in establishing if both modems attempting to connect have V.42 capability.

Dictionary

The term used for compression codes built by the V.42 *bis* data compression algorithm.

Digital Loopback

A test that allows a remote user to run a diagnostic of your modem's receiver and transmitter. The Transmit and Receive circuits at your modem's serial port are not used.

Digital Signals

Discrete, uniform signals. In this manual, the term refers to the **binary digits** 0 and 1.

DTE

Data Terminal (or Terminating) Equipment. Usually, a computer or terminal that generates or is the final destination of data.

Duplex

Indicates a communications channel capable of carrying signals in both directions. See **Half Duplex**, **Full Duplex**.

EIA

Electronic Industries Association, which defines electronic standards in the U.S.

Error Control

Various techniques that check the reliability of characters (**parity**) or blocks of data. V.42 and MNP error-control protocols

use error detection (**CRC**) and retransmission of errored frames (**ARQ**).

Facsimile

A method for transmitting the image on a printed page from one point to another. Commonly referred to as Fax.

Fax Mode

The mode in which the fax modem is capable of sending and receiving files in a facsimile format.

Flow Control

A mechanism that compensates for differences in the flow of data input to and output from a modem or other device.

Frame

A data communications term for a block of data with header and trailer information attached. The added information usually includes a frame number, block size data, error-check codes, and Start/End indicators.

Full Duplex

Signal flow in both directions at the same time. In microcomputer communications, may refer to the suppression of the online **Local Echo**.

Half Duplex

Signal flow in both directions, but only one way at a time. In microcomputer communications, may refer to activation of the online **Local Echo**, which causes the modem to send a copy of the transmitted data to the screen of the sending computer.

Hz

Hertz, a frequency measurement unit used internationally to indicate one cycle per second.

IRQ

Interrupt ReQuest. IRQs in the computer are used to interrupt hardware and software when there is an event that requires attention, such as data arriving at the serial port.

ITU-T

The Telecommunications Sector of the International Telecommunications Union. An international organization that defines standards for telegraphic, telephone, and radio eqipment. Many of the V.x standards governing modem communications are now known under ITU-T, but formerly were **CCITT** authorized. International Telecommunication Union-Telecommunications.

LAPM

Link Access Procedure for Modems, an error-control **protocol** defined in ITU-T Recommendation V.42. Like the **MNP** protocols, LAPM uses cyclic redundancy checking (**CRC**) and retransmission of corrupted data (**ARQ**) to ensure data reliability.

Local Echo

A modem feature that enables the modem to display keyboard commands and transmitted data on the screen.

MNP

Microcom Networking Protocol, an **asynchronous** error-control protocol developed by Microcom, Inc., and now in the public domain. The protocol ensures error-free transmission through error detection (**CRC**) and retransmission of errored frames. The Sportster modem uses MNP Levels 2–4 and Level 5 data compression, which are incorporated into ITU-T Recommendation V.42.

Modem

A device that transmits/receives computer data through a communications channel such as radio or telephone lines. The Sportster is a telephone channel modem that modulates, or trans-

forms, **digital signals** from a computer into the **analog** form that can be carried successfully on a phone line. It also demodulates signals received from the phone line back to digital signals before passing them to the receiving computer.

Nonvolatile Memory (NVRAM)

User-programmable random access memory whose data is retained when power is turned off. Used in Sportster modems to store a user-defined default configuration loaded into random access memory (**RAM**) at power-on and reset, and including a stored phone number.

OFF/ON Hook

Modem operations that are the equivalent of manually lifting a phone receiver (taking it off hook) and replacing it (going on hook).

Online Fallback/Fall Forward

A feature that allows high-speed, error-control modems to monitor line quality and fall back to the next lower speed in a defined range if line quality degrades; as line conditions improve, the modems switch up to the next higher speed.

Originate Mode

A state in which the modem transmits at the predefined low frequency of the communications channel and receives at the high frequency. The transmit/receive frequencies are the reverse of the called modem, which is in **Answer mode**.

Parallel Transmission

The transfer of data characters using parallel electrical paths for each bit of the character, for example, 8 paths for 8-bit characters. Data is stored in computers in parallel form, but may be converted to serial form for certain operations. See **Serial Transmission**.

Parity

An error-detection method that checks the validity of a transmitted character. Character checking has been surpassed by

more reliable and efficient forms of block-checking, including **Xmodem**-type protocols and the **ARQ** protocols implemented in Sportster modems. The same type of parity must be used by two communicating computers, or both may omit parity.

Protocol

A system of rules and procedures governing communications between two or more devices. Protocols vary, but communicating devices must follow the same protocol in order to exchange data. The format of the data, readiness to receive or send, error detection and error correction are some of the operations that may be defined in protocols.

RAM

Random Access Memory. Memory that is available for use when the modem is turned on, but that clears of all information when the power is turned off. The modem's RAM holds the current operational settings, a flow control **buffer**, and a command buffer.

Remote Digital Loopback

A test that checks the phone link and a remote modem's transmitter and receiver.

Remote Echo

A copy of the data received by the remote system, returned to the sending system and displayed on the screen. Remote echoing is a function of the remote system.

ROM

Read Only Memory. Permanent memory, not user-programmable. The Sportster's factory settings are stored in ROM and can be read (loaded) into RAM as an operational configuration if DIP switch 7 is DOWN at power on or reset.

Serial Transmission

The transfer of data characters one bit at a time, sequentially, using a single electrical path. See **Parallel Transmission**.

Start/Stop Bits

The signaling bits attached to a character before the character is transmitted during **Asynchronous Transmission**.

Terminal

A device whose keyboard and display are used for sending and receiving data over a communications link. Differs from a microcomputer in that it has little or no internal processing capabilities.

Terminal Mode

A simulation mode required for microcomputers to transmit data. In Terminal mode the computer acts as if it were a standard terminal such as a teletypewriter, rather than a data processor. Keyboard entries go directly to the modem, whether the entry is a modem command or data to be transmitted over the phone lines. Received data is output directly to the screen.

Throughput

The amount of actual user data transmitted per second without the overhead of protocol information such as Start and Stop bits or frame headers and trailers. Compare **characters per second**.

Transmission Rate

Same as **Bit Rate**.

V.17— Fax

An **ITU-T** standard for facsimile operations that specifies modulation at 14,400 bps.

V.21—Fax

An **ITU-T** standard for making facsimile connections at 300 bps. U.S. Robotics and compatible fax devices then transmit or receive at higher speeds.

V.21—Modem

An **ITU-T** standard for modem communications at 300 bps. Modems made in the U.S. or Canada follow the Bell 103 stan-

dard. However, the modem can be set to answer V.21 calls from overseas.

V.22

An **ITU-T** standard for modem communications at 1200 bps, compatible with the Bell 212A standard observed in the U.S. and Canada.

V.22 bis

An **ITU-T** standard for modem communications at 2400 bps. The standard includes an automatic link negotiation fallback to 1200 bps and compatibility with Bell 212A/V.22 modems.

V.23

An **ITU-T** standard for modem communications at 1200 bps with a 75-bps back channel. Sometimes required in the United Kingdom and Europe.

V.25

An **ITU-T** standard for modem communications that specifies an answer sequence (2100 Hz and 2250 Hz; also requiring an 1800-Hz guard tone) different from the Bell answer tone (2225 Hz) used in the U.S. and Canada.

V.27 ter

An **ITU-T** standard for facsimile operations that specifies modulation at 4800 bps, with fallback to 2400 bps.

V.29

An **ITU-T** standard for facsimile operations that specifies modulation at 9600 bps, with fallback to 7200 bps.

V.32

An **ITU-T** standard for modem communications at 9600 bps and 4800 bps. V.32 modems fall back to 4800 bps when line quality is impaired.

V.32 bis

An **ITU-T** standard that extends the V.32 connection range: 4800, 7200, 9600, 12K and 14.4K bps. V.32 *bis* modems fall back to the next lower speed when line quality is impaired, fall back further as necessary, and also fall forward (switch back up) when line conditions improve.

V.42

An **ITU-T** standard for modem communications that defines a two-stage process of detection and negotiation for LAPM error control. V.42 also supports the MNP error control protocol levels 2–4 and MNP5 data compression.

V.42 bis

An extension of **ITU-T** V.42 that defines a specific data compression scheme for use during V.42 connections.

Word Length

The number of bits in a data character without parity, start or stop bits.

Xmodem

The first of a family of error control software **protocols** used to transfer files between modems. These protocols are in the public domain and are available from many bulletin board services.

XON/XOFF

Standard **ASCII** control characters used to tell an intelligent device to stop/resume transmitting data. In most systems typing Ctrl-S sends the XOFF character. Some devices, including the Sportster modem, understand Ctrl-Q as XON; others interpret the pressing of any key after Ctrl-S as XON.

APPENDIX F. WARRANTY/SERVICE/CERTIFICATION

LIMITED WARRANTY

U.S. Robotics, Inc., warrants to the original consumer or other end-user purchaser that this product is free from defects in materials or workmanship for a period of five years from the date of purchase. During the warranty period, and upon proof of purchase, the product will be repaired or replaced (with the same or similar model) at our option, without charge for either parts or labor. This warranty shall not apply if the product is modified, tampered with, misused, or subjected to abnormal working conditions.

REPAIR OR REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS THE EXCLUSIVE REMEDY OF THE PURCHASER. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE, AND U.S. ROBOTICS SHALL IN NO EVENT BE LIABLE TO PURCHASER FOR INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER.

Some states do not allow the exclusion or limitation of incidental or consequential damages or allow limitations on how long an implied warranty lasts, so the above limitations or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

To obtain service under this warranty, contact the U.S. Robotics Technical Support Department by phone at 800-982-5151; by mail at 8100 North McCormick Blvd., Skokie, Illinois, 60076-2999; or by fax at 708-982-0823. Be sure to have the modem's serial number and proof of purchase handy when you call, or send copies if you are contacting us by mail. You will be given a Return Materials Authorization (RMA) number to help us keep track of your warranty request. Once you receive your RMA number, take or mail the product, postage prepaid, to U.S.

Robotics at the above address. To ensure prompt attention, write the RMA number on the package.

Should you encounter problems in operating this device, follow the instructions in the *Quick Installation* guide, which contains solutions to operating problems as well as procedures to follow if there is an apparent modem malfunction.

FCC REGISTRATION

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

(1) this device may not cause harmful interference;
(2) this device must accept any interference received including interference that may cause undesired operations.

FCC68: CJEUSA-73130-FA-E

RINGER EQUIVALENCE: 0.4B

FCC15: CJE-0216

DOC (CANADA)

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the radio interference regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la classe B prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

UL LISTING/CSA APPROVAL

This information technology equipment is UL-listed and CSA-approved for the uses described in this manual.

CONNECTING TO THE TELEPHONE COMPANY

It is not necessary to notify the telephone company before installing the modem. However, the telephone company may request the telephone number(s) to which the Sportsteris connected and the FCC information printed above.

If the telephone company has any questions or raises problems, ask them to call the Technical Support Department, U.S. Robotics, Inc., 800-982-5151.

If the modem is malfunctioning, it may affect the telephone lines. In this case, disconnect the modem until the source of the difficulty is traced. Do not use the modem on party or coin telephone lines.

RADIO AND TELEVISION INTERFERENCE

This equipment generates and uses radio frequency energy and if not installed and used properly, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. The Sportster modem has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a residential installation.

However, there is no guarantee that interference will not occur in a particular installation. If this device does cause interference to radio or television reception, which you can determine by monitoring reception when the modem is installed and when it is removed from the computer, try to correct the problem with one or more of the following measures.

Reorient the receiving antenna.
Relocate the computer with respect to the receiver.
Relocate the computer and/or the receiver so that they are on separate branch circuits.

If necessary, consult your dealer or an experienced radio/television technician for additional suggestions. You may find

the following booklet, prepared by the Federal Communications Commission, helpful:

How to Identify and Resolve Radio-TV Interference Problems
Stock No. 004-000-0345-4
U.S. Government Printing Office
Washington, DC 20402

In accordance with Part 15 of the FCC rules, any modification to or tampering with this device that causes harmful interference to others may be reason for prohibiting future operation.

FOR CANADIAN MODEM USERS

The Canadian Department of Communications (DOC) label identifies certified equipment. This means the equipment meets certain telecommunications network protective, operational, and safety requirements. The department does not guarantee the equipment will operate to a user's satisfaction.

Before installing this equipment, make sure you are permitted to connect it to the facilities of the local telecommunications company. You must also install the equipment using an acceptable connection method. In some cases, you may also extend the company's inside wiring for single-line, individual service by means of a certified connector assembly (telephone extension cord). You should be aware, however, that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized facility. Any repairs or alterations made by a user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment. For service and, if necessary, repair of your equipment, please follow the procedures in the Warranty/Service section at the beginning of this appendix. Use our toll-free Canada line, 800-982-5151, when calling the USRobotics Technical Support Department (fax: 708-982-0823).

For your own protection, make sure that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Do not attempt to make such connections yourself; contact the appropriate electric inspection authority or electrician.

Sportster 14,400 Load Number: 20

The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to the telephone loop used by the device, without overloading. The termination on a loop may consist of any combination of devices, subject only to the requirement that the total of the Load Numbers of all the devices not exceed 100.

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